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# Essays on Aggregate Liquidity and Corporate Events

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A Thesis in Finance

submitted for the Degree of Doctor of Philosophy

Cass Business School

City University London

November 2009

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# Dedication

To my parents and my wife, for their support and love.

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# Acknowledgements

I am grateful to my supervisor, Dr Huainan Zhao, for his kindness and persistent support during the whole period. This thesis would not have been possible without his exceptional guidance and inspiration. I also like to thank Professor Alec Chrystal for his help during my study. In addition, I would like to express my gratitude to my thesis examiners — Professor Meziane Lasfer and Dr Sanjay Banerji — for their precious comments and suggestions.



## Declaration

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# Abstract

A sizeable stream of theoretical and empirical research in corporate finance reveals that corporate investment and financing activities in capital markets occur in waves through time, which are accompanied with many abnormal phenomena surrounding and after the announcement of events. Motivated by existing studies in firm-level and aggregate-level liquidity, which suggest the influence of (aggregate) liquidity on the activity and quality of corporate events, the purpose of this thesis is to investigate and understand the role of aggregate liquidity in explaining existing phenomena associated with corporate investment and financing events including mergers and acquisitions (M&A), initial public offerings (IPOs), seasoned equity offerings (SEOs), and, finally, corporate asset sales.

Liquidity is an important and special asset for firms operating in imperfect capital markets. At aggregate level, corporate holdings of liquidity and the market provision of liquidity play important roles in capital markets, which inevitably affect the decision making and performance of corporate events. In this research, I investigate whether corporate investment and financing events occurring during high aggregate liquidity markets are fundamentally different from those occurring during low aggregate liquidity markets.

Empirical evidences in this research show that the activity and quality of major corporate investment and financing events are substantially influenced by aggregate liquidity. Moreover, many of the market anomalies concentrate in certain aggregate liquidity conditions. For M&A, I find that there are more acquisitions in high-liquidity periods, and acquirers buying during high-liquidity markets have significantly higher pre-announcement returns, but lower post-merger abnormal returns. For IPOs and SEOs, results show that there are many more public equity offerings in high-liquidity periods than in low-liquidity periods. Offering firms selling securities during high-liquidity markets have significantly higher occurrences of underpricing (discounting) and suffer larger long-run underperformance. For asset sales, high-liquidity divesting firms have better performance measured by firm characteristics and post-sale returns.

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# Chapter 1

## Introduction

A growing body of research documents that industrial firms hold liquid assets, defined as cash and marketable securities, and tend to do so for an extensive period of time (e.g. Opler, Pinkowika, Stulz, and Williamson (1999) and Bates, Kahle, and Stulz (2009)). This corporate liquidity demand has attracted considerable attention from academic research and media coverage. For instance, an article in the *Wall Street Journal* states that “The piles of cash and stockpile of repurchased shares at big U.S. companies have hit record level.”<sup>1</sup> As ongoing entities, corporations are usually concerned that they might run out of funds to take advantage of existing investment opportunities, strengthen existing developments, or simply stay alive. In contrast to a perfect capital market, a firm’s desire to reserve liquidity is driven by its inability to pledge all of the expected income from investments. Due to this partial non-pledgeability of investment returns, firms will require a cushion against any future liquidity shocks (see Holmström and Tirole (1996, 1998, 2001)). Thus, the corporate holdings of liquidity play strategic and important roles in the corporate decisions of investment and financing.

In corporate finance, a substantial amount of studies have examined corporate investment and financing activities and the related abnormal performance of event

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<sup>1</sup>“Capital Pains: Big Cash Hoards”, by Ian McDonald, *Wall Street Journal*, July 21, 2006, p. C1.

firms in financial markets. Significant evidence has been found in academic literature in the past thirty years; research in this field can be roughly divided into the following two parts. First, many studies investigate the information conveyed by these corporate investment and financing events and examine the reaction of financial markets. In particular, shareholders' returns, which initiate these investment and financing activities, are examined. For instance, acquiring firms in corporate takeovers and offering firms in equity issuances are documented with significantly negative stock performance in the long-term post-event periods.<sup>2</sup> Second, many studies demonstrate that the aggregate activity and performance of corporate events change greatly through time.<sup>3</sup> Evidence also shows that the volume of acquisitions and equity issuances changes greatly through time.

Given the existence of these puzzles, enormous effort has been dedicated to explaining these market anomalies associated with corporate investment and financing activity. Previous studies have suggested various explanations and theories.<sup>4</sup> Although some of them found strong indicators for these market anomalies, there are still extensive debates on the existence and reasons for these puzzling phenomena; so far, theoretical and empirical evidences are far from comprehensive. Brealey, Myers, and Allen (2008) state that explaining "financial fashions" is one of the main unsolved questions in corporate finance.

Considering the universal need to hoard liquid assets, I observe that aggregate liquidity (demand and supply) is cyclical through time. At aggregate level, the corporate liquidity holding and market liquidity supply recurrently experience periods of expansion and contraction. This pattern of aggregate liquidity cannot be easily

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<sup>2</sup>For studies on post-acquisition performance, see Franks, Harris, and Titman (1991), Agrawal, Jaffe, and Mandelker (1992), and Loughran and Vijh (1997). For studies on post-issuance performance, see Ritter (1991), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995).

<sup>3</sup>See, for example, Andrade, Mitchell, and Stafford (2001), Lowry and Schwert (2002), Lowry (2003), and Harford (2005).

<sup>4</sup>Typical studies include Rau and Vermaelen (1998), Brav, Geczy, and Gompers (2000), Eckbo, Masulis, and Norli (2000), Moeller, Schlingemann, and Stulz (2004), Lyandres, Sun, and Zhang (2008), and Bouwman, Fuller, and Nain (2009).

overlooked, as these macro factors carry potentially important implications with regard to firms' subsequent investments and external financing. Similarly, early studies such as Choe, Masulis, and Nanda (1993) applied the macro factor of business cycle to analyse common stock offering. Further, Holmström and Tirole (2001) have developed a liquidity-based asset pricing model (LAPM), and show that aggregate liquidity has systematic implications on the pricing of financial assets. The variation of asset pricing due to the variations of aggregate liquidity in turn affects corporate decision making and subsequent performance.

While fully recognising the achievements of previous research in providing explanations for abnormal phenomena in corporate investment and financing activities, I consider these shortcomings and unsolved puzzles in the literature as an invitation to explore possible alternative factors and explanations. Despite the importance of corporate liquidity reserves and market liquidity supply, limited attention has been given to exploring the influences of corporate liquidity on corporate decisions.<sup>5</sup> Moreover, no previous research has investigated the effects of aggregate liquidity on corporate events, or examined whether the performance of event firms is related to aggregate liquidity factors.

The main objective of this thesis, therefore, is to investigate the role of aggregate liquidity on major corporate investment and financing events including mergers and acquisitions (M&A), initial public offerings (IPOs), seasoned equity offerings (SEOs), and, finally, corporate asset sales. Aggregate liquidity factors consist of aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS). For ACLD, I follow Greenwood (2005), and use data reported in the Federal Reserve *Flow of Funds* to construct a measure of aggregate corporate accumulation of liquid asset as a fraction of total corporate investment spending. For AMLS, I follow Krishnamurthy and Vissing-Jorgensen (2008), and use the U.S. *Debt/GDP* ratio.

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<sup>5</sup>Typical studies include Harford (1999), Opler, Pinkowika, Stulz, and Williamson (1999), Mikkelsen and Partch (2003), and Oler (2008).

Construction methods and reasons are discussed in detail in Chapter 3; both liquidity measures are applied to test their association with these major corporate investment and financing activities. Moreover, I examine whether aggregate liquidity can explain various abnormal phenomena related with corporate events. Overall, I classify each sample of event firms based on aggregate liquidity data and examine the performance and characteristics of event firms in various liquidity conditions.

The purpose of this research is not to provide an exclusive factor for market anomalies associated with the aforementioned four major corporate decisions. Simply, I intend to explore and examine an alternative explanation, which could eventually help to close the gap between our understanding of corporate finance and documented empirical anomalies related to corporate investment and financing activities. Specifically, this research aims to empirically investigate whether corporate investment and financing events undertaken during markets with high aggregate liquidity are fundamentally different from those undertaken in low aggregate liquidity environments. After this brief tour of the main ideas and purposes of this thesis, I will describe the background and motivation of this research in some more detail.

## **1.1 Research Background and Motivation**

In this thesis, the demand and supply of aggregate liquidity are linked with the corporate decisions of investment and financing, which creates a number of important questions, as follows. Why are M&A, IPOs, SEOs, and asset sales chosen as representatives of corporate investment and financing events? Why are there potential correlations between aggregate liquidity and corporate events? And why does the aggregate liquidity influence the performance of firms undertaking corporate events?

To address the correlation between corporate decisions and aggregate liquidity, it is important to construct samples of proper and typical corporate events. In this thesis, I choose M&A, IPOs, SEOs, and asset sales based on the following reasons.

First, acquisitions and equity issuances are the major, and most likely, largest investment and external financing events undertaken by companies. In practice, such kinds of investment and financing activities can greatly change the size of a company, as well as the cost of capital; the releasing of information related to them has a substantial influence on the financial markets in both the short- and long-term. It is reasonable to believe that, before taking these investment and financing decisions, management has analysed the influence of liquidity demand and supply, if not been driven by them.

Second, in academic literature, there is a large amount of studies focusing on M&A, IPOs, SEOs, and asset sales in corporate finance. Extensive attention has been devoted to almost every aspects, whereby many studies have documented anomalies associated with corporate events and delivered some explanations for these abnormal phenomena. In the literature of M&A, early research in the 1980s investigates the stock performance of target firms and acquiring firms at the time of announcement. More recent studies focus more on the long-term stock and operating performance of acquiring firms after acquisitions.<sup>6</sup> Jensen and Ruback (1983) and Agrawal and Jaffe (2000) provide a comprehensive survey on the wealth effects of announcement and the post-acquisition performance of takeovers, respectively. For equity issuances, a great deal of attention is devoted to the debates regarding short-run underpricing, long-run underperformance, and fluctuations in the volume and underpricing of issuances through time.<sup>7</sup> Ritter and Welch (2002) and Ritter (2003) greatly summarise previous major studies on equity issuances literature. Further, in asset sales literature, valuation effects of divestiture announcements and motivations for asset sales have been investigated widely.<sup>8</sup>

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<sup>6</sup>See, for example, Franks, Harris, and Titman (1991), Agrawal, Jaffe, and Mandelker (1992), Loughran and Vijh (1997), and Rau and Vermaelen (1998).

<sup>7</sup>Some notably studies include Smith (1986), Loughran, Ritter, and Rydqvist (1994), Ritter (1991), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995), and Lowry (2003).

<sup>8</sup>See, for example, Hite, Owers, and Rogers (1987), Lang, Poulsen, and Stulz (1995), and Bates (2005).



Third, corporate decisions on asset sales is selected because of its unique relations with both M&A and equity issuances; divesting firms in asset sales are similar to target firms in acquisitions. The major difference is that target firms lose control of the company after an acquisition, where the divesting firms only liquidate part of their assets to gain external funds. Thus, the market reaction to the announcement of these events should be similar, where, in general, positive abnormal returns surrounding the announcement are realised. Moreover, in terms of corporate external financing, asset sales is an alternative path for firms to raise funds in capital markets other than IPOs and SEOs. In equity issuances, firms sell securities (equity or bond) to outside investors to obtain funds, while in asset sales, firms sell assets (company divisions, plants) to obtain capital. Therefore, considering the influence of aggregate liquidity on asset sales not only shows the correlations between them, but also complements our understanding of M&A and equity issuances.

Inspired by previous studies found in liquidity literature, the second question, which is about the correlations between aggregate liquidity and corporate decisions, can be answered from two standpoints. In particular, studies considering firm-level liquidity and aggregate-level liquidity both provide threads for establishing correlations between aggregate liquidity and corporate events. Note that the liquidity this thesis relates to the value of financial instruments used to transport wealth across time and to back up promises of future payments. It represents those cash equivalent assets that can be quickly reallocated at no extra, or at very low, cost.

*At the firm-level of liquidity*, a large amount of studies consider the benefits and costs associated with liquidity holdings by corporations. Substantial evidence points out the strategic role of liquid assets in corporate decisions relating to investment and external financing. For instance, Shleifer and Vishny (1992) argue that an increase in cash simultaneously increases fundamental value and relaxes financial constraints, which causes the clustering of mergers in booms. Through empirical analysis, Harford (1999) shows that firms that have built up large liquidity reserves are more

active in the acquisition market, and their acquisitions are value-decreasing. Further, Mikkelsen and Partch (2003) and Oler (2008) report that holdings of liquidity can even predict firms' performance. As indicated in Opler, Pinkowika, Stulz, and Williamson (1999): "...holding an additional dollar of liquid assets reduces the probability of being short of liquid assets, and decreases the costs of being short of cash".

When a firm experiences a liquidity shortage, it might have to withdraw current investments, cut back dividends, or raise funds by selling securities or assets. Maintaining sufficient liquid assets reduces the probability of these 'unwilling' events, and allows firms to take advantage of existing investment opportunities. Consistent with this argument, a recent report in *Forbes* states that "If you've got enough money, you can launch an acquisition binge and boldly snap up the technologies that will sell well when the economy rebounds."<sup>9</sup> For example, IBM, the technology company with the largest liquidity reserves, can afford to snap up server company Sun Microsystems, with cash, and still have \$6 billion in cash left over.

As early as Keynes (1936), much of the early literature investigated the transaction cost motive as a benefit of liquidity reserves.<sup>10</sup> However, the benefits of holding liquid assets are much broader than simply saving transaction costs. Another well-documented benefit is the precautionary motive for holding cash. In the presence of capital market imperfections, liquidity can be served as a buffer stock to finance firms' investments, even when other sources of funding are insufficient. Consistent with the precautionary motive, Myers and Majluf (1984) argue that since information asymmetry will induce financing constraints, firms should hold liquid assets to finance future investment opportunities. In short, corporate liquidity holdings benefit firms by reducing the underinvestment dilemma.

However, corporate liquidity holdings also come with large potential costs, in addition to their benefits. Easterbrook (1984) suggests that frequent visits to the

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<sup>9</sup>"IBM: Tech's Cash King", by Brian Caulfield, *Forbes*, March 18, 2009.

<sup>10</sup>See, for example, Baumol (1952), Miller and Orr (1966, 1968), Vogel and Maddala (1967), and Frenkel and Jovanovic (1980).

capital markets helps control agency problems, where plentiful internal funds reduce the effectiveness of this control mechanism. Jensen (1986) argues that firms should reserve no extra liquidity to minimise the agency cost of free cash flow, which is derived from agency conflict that exists between owners and managers. As argued in Harford (1999), the same freedom from external financing that makes cash reserves valuable can be abused by managers, because of their desire to reduce their personal undiversified risk or increase the scope of their authority. These two most prominent points of view on the benefits and costs of holding liquid assets in the academic literature suggest that firms should either hold large amounts of liquid assets or no liquid assets whatsoever.

The trade-off between benefits and costs has been more systematically examined by a number of studies since the late 1990s. Kim, Mauer, and Sherman (1998) find that a firm's decision to invest in liquid assets and the optimal amount of liquidity are determined by a trade-off between the low return by holding liquid assets and the benefit of minimising the need for costly external financing. Similarly, Opler, Pinkowika, Stulz, and Williamson (1999) also investigate the determinants and implications of holding liquid assets. Their results indicate that firms with strong growth opportunities and riskier activities hold more cash, while firms with the greatest access to the capital market tend to hold less liquidity. Harford (1999) explores the relation between a firm's acquisition policy and its liquid asset holdings. Consistent with the predictions of the free cash flow hypothesis, he finds that liquidity-rich firms are more likely to make acquisitions. He further argues that agency conflicts between managers and stockholders, combined with large reserves of liquidity, which insulate managers from monitoring by external markets, produce value-decreasing investment decisions (acquisitions).

*At the aggregate-level of liquidity*, some theoretical and empirical research investigates the importance of aggregate liquidity on various issues. Many of them suggest the link between aggregate liquidity, especially the aggregate market liquidity supply,

and the premium of liquid assets. In a world of imperfect capital markets, holdings of liquid assets that have a liquidity premium are accompanied with opportunity costs. Again, companies should balance the benefits and costs of holding liquid assets, which are affected by the aggregate market's liquidity supply. Therefore, corporate investment and financing decisions are also related to liquidity at the aggregate level.

Most related, Greenwood (2005), by constructing aggregate corporate liquidity investment (demand), finds strong evidence that aggregate investment in liquid assets as a share of total corporate investment is negatively related to subsequent U.S. stock market returns. His results suggest that the aggregate corporate sector actively times security issuance relative to investment needs, where liquidity accumulation is the consequence of overvalued firms taking advantage of issuing external finance. Eisfeldt and Rampini (2009) characterise the business cycle properties of aggregate liquidity, arguing that the use of liquidity to hedge investment opportunities by the corporate sector can generate a substantial liquidity premium with empirically observed countercyclical properties.

Notably, the theoretical research of Holmström and Tirole (1996, 1998, 2001) greatly increases our understanding on the importance of aggregate liquidity demand and market liquidity supply. Holmström and Tirole (1996, 1998) establish a theoretical model on corporate liquidity demand (advanced financing) and link the corporate financing problem with the market supply of liquidity, which leads to findings regarding corporate and government liquidity policies. Starting with this aggregate liquidity consideration, Holmström and Tirole (2001) establish a liquidity-based asset pricing model (LAPM) and show that the resulting model, which is affected by aggregate liquidity, can better explain a liquidity premium in capital markets. Besides theoretical achievements, empirical evidences have been found in Krishnamurthy and Vissing-Jorgensen (2008) and Sundaresan and Wang (2009), suggesting that aggregate market liquidity supply and the liquidity premium are related.

In summary, liquidity has been an important element in firms' ongoing operating

and decision making processes. In academic research, researchers' understanding and attitudes toward corporate liquidity evolve through time, from stressing the benefits or costs of holding liquidity separately, to considering the trade-off between them. Previous studies on firm-level liquidity suggest the universal needs for holding liquidity and the influences of liquidity on corporate investment and financing decisions.<sup>11</sup> Since aggregate liquidity captures the integrated variations of liquidity, it should not only reflect the consequence of firm-level liquidity on corporate decisions, but also the variations of business and investment circumstances. In addition to studies on firm-level liquidity, my intention in applying aggregate liquidity into corporate investment and financing decisions is also inspired by previous research, which directly models the factors of aggregate liquidity.<sup>12</sup> These papers theoretically model the importance of aggregate liquidity and establish the links between aggregate liquidity and valuation. Considering the role of firm and market valuation in corporate finance, it is reasonable to expect that aggregate liquidity also plays a crucial role in these corporate finance decisions.

In this thesis, I empirically investigate the influences of aggregate liquidity on four major corporate investment and financing activities: M&A, IPOs, SEOs, and asset sales. Originated from two streams of research on liquidity (firm-level liquidity and aggregate-level liquidity), I ask the following questions: Are corporate investment and financing events initiated when aggregate liquidity is high fundamentally different from those initiated during low aggregate liquidity periods? Can aggregate liquidity factors explain the market anomalies associated with typical corporate events? Although previous research has established some results, especially at firm-level liquidity, there are currently no formal empirical studies on aggregate liquidity. Such macro factors carry potential implications with regard to firms' subsequent

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<sup>11</sup>See, for example, Harford (1999), Opler, Pinkowika, Stulz, and Williamson (1999), Harford (2005), Officer (2007), and Bates, Kahle, and Stulz (2009).

<sup>12</sup>See, for example, Holmström and Tirole (1996, 1998, 2001), and Krishnamurthy and Vissing-Jorgensen (2008)

investments and financing decisions, which should not be easily overlooked.<sup>13</sup> Focusing on aggregate liquidity factors also allows me to explore certain anomalies in corporate events such as merger waves, variations in IPO and SEO volume, etc. It is relatively difficult to examine these abnormal phenomena with firm-level factors. Moreover, aggregate market liquidity supply can be employed to examine the effects of liquidity premium on corporate events, which cannot be captured in cross-section analysis. In the field of asset pricing, only a limited amount of studies have investigate the influences of aggregate liquidity supply. The current research is among the first to consider its implication on corporate decisions.

## 1.2 Main Findings and Contribution

Empirical evidence in this research strongly suggests that corporate investment and financing activities are influenced by aggregate liquidity, as the activity and performance of corporate events undertaken during high aggregate liquidity markets are fundamentally different from those undertaken during low aggregate liquidity periods. Based on factors of aggregate liquidity, my basic specification classifies sample periods into high-liquidity (30%), medium-liquidity (40%), and low-liquidity (30%) periods (or markets), according to the prior year's aggregate liquidity. For instance, the M&A (IPO) market in year  $t$  is defined as high-, medium-, and low-liquidity markets based on the level of aggregate liquidity in the year  $t - 1$ . Correspondingly, acquiring (issuing) firms initiating acquisitions during high-, medium-, and low-liquidity markets are classified as high-, medium-, and low-liquidity acquirers (issuers). Next, the performances of event firms in different liquidity markets are measured and compared. In fact, this method has been widely used in previous

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<sup>13</sup>Some early studies such as Choe, Masulis, and Nanda (1993) applied macro economic factors to analyse corporate events.

studies.<sup>14</sup> In contrast to these studies, I define a period of market condition according to the aggregate liquidity data from the previous year, because both measures of aggregate liquidity belong to the category of leading economic indicators, which tend to rise or fall in advance of the rest of the economy.<sup>15</sup> Unlike financial market data, which can be observed fairly quickly, data items for constructing aggregate liquidity factors are usually updated quarterly or annually, normally with a certain amount of delay. It is important to note that, although I applied the previous  $(t - 1)$  year's aggregate liquidity factors to classify current  $(t)$  year's corporate events, the major empirical results remain similar and significant when I used the current  $(t)$  year's aggregate liquidity factors. Therefore, the results of current research are not sensitive to the one-year lag in aggregate liquidity measures.

To show that the results are not affected by the length of sample period, for each corporate investment and financing event the constructed samples cover the longest periods of available data in the database. The samples of mergers, IPOs, SEOs, and asset sales are all collected from the Thomson One Banker Data Analysis Database. This database is exactly the same as the Securities Data Corporation (SDC) Database, which is the most widely used data source for major corporate events.<sup>16</sup> The data coverage for merger sample (4,162 deals), IPO sample (5,529 deals), SEO sample (6,100 deals), and asset sale sample (2,793 deals) is one of the largest in the each corresponding literature.<sup>17</sup> The sample period of each sample is split into high-, medium-, and low-liquidity markets in order to compare the activity and performance of firms that announced events under those different aggregate

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<sup>14</sup>See, for example, Ritter (1984), Choe, Masulis, and Nanda (1993), Bayless and Chaplinsky (1996), Helwege and Liang (2004), Yung, Çolak, and Wang (2008), and Bouwman, Fuller, and Nain (2009).

<sup>15</sup>For discussion on leading, coincident, and lagging economic indicators, see p.576-582 and Table 17.2 in Bodie, Kane, and Marcus (2008).

<sup>16</sup>Discussion with Thomson One Banker employees verified that both databases are the same.

<sup>17</sup>For comparison, Loughran and Ritter's (1995) sample contains 4,753 IPOs and Brav, Geczy, and Gompers's (2000) sample includes 4,622 IPOs. In addition, the samples in Loughran and Ritter (1995), Eckbo, Masulis, and Norli (2000) and Brav, Geczy, and Gompers (2000) consist of 3,702, 4,766, and 4,526 SEOs, respectively.

liquidity circumstances.

In the empirical analysis, I examine the correlations between aggregate liquidity and the aggregate activity of corporate investment and financing events. The results from such an analysis can help in understanding the causes and consequences of the fluctuation of takeover, IPO, and SEO volume. Moreover, besides comparing the activity of corporate decisions in different states of aggregate liquidity, I systematically examine the short-run and long-run performance of event firms, as well as the variation of typical firm characteristic variables. By linking aggregate liquidity with event firm performance, this research provides preliminary efforts in analysing the influence of aggregate liquidity on the performance of corporate events.

The main findings in this thesis are as follows. First, the aggregate activity of corporate events is significantly affected by the variation of aggregate liquidity. In general, there are more (less) investment and financing activities initiated in the periods of high (low) aggregate liquidity. I have found substantial evidences that there are more acquisitions and equity issuances in high- and medium-liquidity markets than in low-liquidity periods. The activity of corporate events increases in the value of aggregate liquidity for most of the cases, and remains robust after controlling for various deal characteristics. For instance, I have controlled other macro economic factors such as GDP growth and stock market index in multivariate regression analysis. Why there are more corporate activities in high aggregate liquidity status? At aggregate-level, sufficient liquidity is usually accompanied by better business and investment environments, which consequently induces more corporate activities. In addition, high-liquidity markets provide more easy money for firms to undertake investment or financing, even though these deals are more likely to be value-decreasing decisions.

Second, the performances of event firms show strong correlations with aggregate liquidity. High-liquidity events have much larger probability of experiencing over- or under-performance, while low-liquidity events tend to have normal performance.



More importantly, many of the 'pervasive' market anomalies associated with corporate decisions are mainly driven by deals initiated in certain aggregate liquidity conditions. The differences in performance, measured in both the short- and long-term, between event firms announcing decisions in high-liquidity markets and those announcing decisions in low-liquidity markets are economically and statistically significant. Therefore, empirical results indicate that many of the well-documented abnormal performances can be captured by aggregate liquidity factors, which strongly suggests that corporate investment and financing events announced in high-liquidity markets are fundamentally different from events initiated in low-liquidity markets. In particular, for M&A, I find that there are more acquisitions in high-liquidity states, and acquirers buying during high-liquidity markets have higher returns before and around the announcement date. Interestingly, although firms that acquire when the market is sufficiently liquid produce significantly higher short-run returns than firms that acquire when the markets are short of liquidity, they generate significantly lower long-run abnormal stock performance, as measured by BHAR and CTPR. For IPOs and SEOs, the results show that there are many more public equity offerings in high- and medium-liquidity periods than in low-liquidity periods. Offering firms selling securities during high-liquidity markets have a significantly higher degree of underpricing (or discounting) and suffer significantly larger long-run underperformance following public issuances.

In summary, this research contributes to the current literature in four ways. First, it increases our understanding of how corporate investment and financing activities, in aggregate, are affected by the aggregate liquidity environments. In this study, aggregate liquidity is documented to be an important market condition factor in explaining the anomalies associated with corporate events; no previous study has empirically investigated the importance of aggregate liquidity. This research is a preliminary effort to analyse the influence of aggregate liquidity on four major corporate investment and financing decisions. My research aligns with the stream of

research in corporate finance: market-timing theory. In the literature, the theory of market valuation is applied to explain the acquisition activities and subsequent performance of acquiring firms (see, e.g., Shleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004), Rhodes-Kropf, Robinson, and Viswanathan (2005), Dong, Hirshleifer, Richardson, and Teoh (2006), and Bouwman, Fuller, and Nain (2009)), and to explain activity and performance equity issuances (see, e.g., Bayless and Chaplinsky (1996), Lowry (2003), and Helwege and Liang (2004)). Compared to these studies, instead of using market valuation or volume factors, my research partitions market conditions through time based on factors of aggregate liquidity, and then examines the performance of event firms.

Second, the results contribute to understanding the role of corporate liquidity reserves. Previous research suggests that high holdings of liquidity can increase agency problems by causing value-decreasing investments (see Jensen (1986) and Harford (1999)). However, Opler, Pinkowika, Stulz, and Williamson (1999) and Mikkelsen and Partch (2003) show that corporate cash reserves are not harmful, perhaps, even beneficial to firm performance. Sufficient holdings of liquid assets increase firms' financial flexibility. This research complements this trend of research with measures of aggregate liquidity. Consistent with agency problem theories, the empirical results show that high-liquidity holding and supply (at aggregate level) usually lead to value-decreasing investment and financing decisions, where most of the event firms experience negative long-term performance in the post-event periods.

Third, this research sheds light on the importance of aggregate market liquidity supply on corporate investment and financing activities. Inspired by studies examining the effects of changing supply of aggregate liquidity on liquidity premium in capital markets,<sup>18</sup> I use aggregate market liquidity supply (AMLS) as an additional measure of aggregate liquidity to examine whether changing the liquidity premium

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<sup>18</sup>See, for example, Holmström and Tirole (2001), Krishnamurthy and Vissing-Jorgensen (2008), and Sundaresan and Wang (2009).

has an influence on corporate decisions. This liquidity factor is constructed to represent the liquidity condition in the supply side of the economy.

Finally, by employing extensive sample periods, this research provides further empirical evidences on the performance of event firms in major corporate investment and financing events. The sample period and sample size of M&A, IPOs, SEOs, and asset sales are among the largest in the corresponding literature. I have collected all available transaction deals in the SDC for each corporate event after screening some criteria. The performance of all event firms in each sample are consistent with the previous findings in the literature; empirical results based on such a long sample period further complement early documented empirical findings.

The remainder of this thesis is organised as follows. In Chapter 2, I review the related literature for this research. In Chapter 3, I describe the construction methods used for aggregate liquidity measures (ACLD and AMLS) and argue the reasons for choosing these measures. Moreover, I also briefly review the empirical methodology for this study. Chapter 4 examines the sample of mergers with aggregate liquidity factors. Chapter 5 examines the sample of IPOs and the sample of SEOs with aggregate liquidity factors. In Chapter 6, aggregate liquidity factors are applied to explain corporate asset sales. Chapter 7 summarises and concludes the findings in this thesis. Limitations and potential future research ideas are also stated.

# Chapter 2

## Literature Review

### 2.1 Introduction

This chapter provides a literature review on research related to this thesis. Since I explore the potential correlations between aggregate liquidity and typical corporate investment and financing events, several fields of research in finance, especially in corporate finance, are covered. In particular, I review studies in the field of corporate liquidity demand, market liquidity supply, mergers and acquisitions (M&A), public securities issuance (IPOs and SEOs), and, finally, asset sales and corporate divestitures.

It is important to note that given the large and burgeoning literature on various aspects of each of these research areas, comprehensive coverage is unlikely without a book-length research review. Moreover, it is better to concentrate mostly on those aspects associated with the main focuses of this thesis. Therefore, the literature review in this chapter can be broadly separated into two parts. Part A contains research on corporate liquidity demand and market liquidity supply. For corporate liquidity demand, I start with firm-level liquidity studies, which suggest the strategic role of liquid assets in the making of investment and external financing decisions by corporations. Next, I review studies concentrating on aggregate corporate liquidity

demand and aggregate market liquidity supply. Part B contains studies on various aspects of mergers and acquisitions (M&A), initial public offerings (IPOs), seasoned equity offerings (SEOs), and corporate asset sales. Instead of providing full coverage on these topics, I mainly focus on studies which examine the market anomalies associated with these corporate events.<sup>1</sup> In the following chapters, aggregate liquidity measures are tests as potential factors for these abnormal performances.

The remainder of this chapter is organised as follows. In Section 2.2, studies on corporate liquidity demand, both at firm-level and aggregate-level, are reviewed. Section 2.3 summarises studies in market liquidity supply. Section 2.4 reviews related prior works in M&A. In Section 2.5, short-term and long-term reactions to IPOs and SEOs are summarised, with additional discussions on the motivations and volume of equity issuance. Section 2.6 reviews studies in asset sales and corporate divestitures.

## 2.2 Corporate Liquidity Demand

There is substantial evidence that corporations accumulate liquid assets and hold them for a substantial period of time. This corporate liquidity demand has attracted many researchers' attentions. Many efforts have been devoted to answering questions such as why do firms hold so many liquid assets? What are the benefits and costs of holding liquidity? Most liquidity studies focus on the corporate liquidity demand at the firm-specify level. Very few, however, investigate the importance of liquidity demand at the aggregate level. This section reviews studies which investigate (1) the determinants of corporate liquidity holdings at the firm-level and (2) the importance of liquidity at the aggregate level.

Liquidity is a complex concept. In this thesis, the term 'liquidity' refers to the value of financial instruments used to transport wealth across time and to back

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<sup>1</sup>Such concentration is more related to the purpose of this thesis. In empirical analysis, I explicitly examine the influence of aggregate liquidity on the performance (market anomalies) of corporate events.

up promises of future payments. It represents those liquid assets which can be quickly reallocated at very low cost. In the vast amount of literature written on the subject of liquidity, many studies investigate the relationship between asset prices and liquidity.<sup>2</sup> However, in these papers, ‘liquidity’ refers to the ease of trading a security, which is different from the definition of liquidity within the present study.

### 2.2.1 Determinants of Corporate Liquidity

Under perfect capital market assumptions, holdings of liquid assets are irrelevant to corporations. If there is a liquidity shortage, a firm can always raise funds to cover this demand at zero cost, which means that holdings of liquid assets have no opportunity cost. However, when various imperfections are introduced, such that it is costly for the firm to raise funds at short notice, then there is a trade-off between the marginal costs of holding liquid assets and the marginal benefits of holding those assets. As stated in Opler, Pinkowika, Stulz, and Williamson (1999), “holding an additional dollar of liquid assets reduces the probability of being short of liquid assets, and decreases the costs of being short of cash”. Therefore, corporations have substantial demand for liquidity, and the level of optimal liquidity holdings is widely examined by the *trade-off model* in the literature.<sup>3</sup>

The trade-off model suggests that managers should set the firm’s liquidity holdings at a level such that the marginal benefits and costs of holding liquid assets are equal. Holding liquidity has benefits that arise from different facets. First, firms do not have to pay transaction costs to frequently raise funds and do not have to liquidate assets or sell securities to make payments. Keynes (1936) describes these benefits as the *transaction cost motive* for holding cash (e.g. Baumol (1952) and

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<sup>2</sup>See, for example, Pástor and Stambaugh (2003), Acharya and Pedersen (2005), Chordia, Sarkar, and Subrahmanyam (2005), Amihud, Mendelson, and Pedersen (2006), Liu (2006), Bekaert, Harvey, and Lundblad (2007), and Beber, Brandt, and Kavajecz (2009).

<sup>3</sup>Alternative views on the trade-off model are the pecking order model and financing hierarchy model. Existing studies and evidence in the literature broadly support the trade-off model.

Miller and Orr (1966, 1968)). Second, and more specifically, firms can utilise their reserves of liquid assets to finance activities and investments if other sources of funding are too costly, which is referred to as the *precautionary motive* for holding cash (e.g. Frenkel and Jovanovic (1980)).

Besides benefits, there are also the costs involved with holding liquid assets. First, the direct cost of holding liquidity is the lower rate of return because of a liquidity premium and the tax expense on the interest income. Foley, Hartzell, Titman, and Twite (2007) find that U.S. corporations facing higher repatriation taxes hold higher levels of cash and, consequently, hold this cash abroad. Another cost of holding liquidity is agency problems between managers and shareholders, whereby management may not use the liquid assets in the best interests of the firm.

Early studies that explore the optimal amount of liquidity holdings for corporations suggest that firms should either hold large amounts of liquidity or no liquid assets at all, because these studies either consider the benefits of holding liquid assets or the costs of those holdings, instead of both sides. Myers and Majluf (1984) argue that since information asymmetry will induce financing constraints, firms should hold liquid assets to finance future investment opportunities with internal funds. Huberman (1984) develops a model to examine an interior optimal level of investment liquid assets, and concludes that firms should invest in liquid assets to fund future investment opportunities. These studies provide support for the precautionary motive for holding liquid assets. However, both of them fail to include the offsetting costs of holding liquid assets in their model, and only consider the benefits of those holdings. Not surprisingly, in this setting, it is optimal to hold large amounts of liquid assets. These suggestions for the optimal amount of liquidity are incomplete.

In contrast, considering the costs of liquidity holding, Jensen (1986) argues that firms should reserve no extra liquidity to minimise the agency cost of free cash flow. In favour of Jensen's (1986) free cash flow theory, Blanchard, Lopez-De-Silanes, and Shleifer (1994) find that firms receiving cash windfalls spend their new-found

cash inefficiently. Similarly, Easterbrook (1984) suggests that firms should pay out dividends to revisit the capital market frequently, which would help control the agency conflict between shareholders and managers. Without the benefits obtained from liquid assets, these studies imply that it is optimal for firms to carry no liquid assets.

Most of the following theoretical studies include both the benefits and costs of holding liquid assets to develop predictions about the determinants of corporate liquidity. Kim, Mauer, and Sherman (1998) argue that the optimal amount of liquidity is determined by a trade-off between the cost of the low return earned on liquid assets and the benefit of minimising the need for costly external financing. They find that the optimal liquidity investment is positively related to the cost of external financing, the variance of future cash flows, and the return on future investment opportunities. Holmström and Tirole (2000) find that firms have desires to hoard liquidity in advance, and the firms' demand for liquid assets depends on whether and how much the asset will deliver when the firm needs cash.

The benefits of holding liquid assets (transaction motive, precautionary motive) and the costs of holding liquid assets (agency motive, tax motive) have been widely examined. Among these topics, *precautionary motive* and *agency motive* have attracted the biggest attentions. Almeida, Campello, and Weisbach (2004) model the precautionary demand for cash, and find that financially constrained firms have a propensity to save cash out of cash flows, which is referred to as the *cash flow sensitivity of cash*,<sup>4</sup> while unconstrained firms' cash savings are not related to cash flows. Khurana, Martin, and Pereira (2006) find the sensitivity of cash holdings to cash flows decreases with financial development with data for 35 countries, which supports findings in Almeida, Campello, and Weisbach (2004). Han and Qiu (2007) show that an increase in the volatility of cash flow increases cash holdings for firms that are finan-

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<sup>4</sup>The cash flow sensitivity of cash contrasts with the cash flow sensitivity of investment, which examines the effects of financial constraints on corporate investment demand. See, for example, Fazzari, Hubbard, and Petersen (1988) and Kaplan and Zingales (1997).



cially constrained, but has no determinate effect on other firms. Acharya, Almeida, and Campello (2007) examine both the propensity to save out of cash flow and the propensity to issue debt. They find that constrained firms prefer higher cash to lower debt if their hedging needs are high, but lower debt to higher cash if their hedging needs are low.

In line with the agency problem motive, Dittmar, Mahrt-Smith, and Servaes (2003) find cross-country evidence suggesting that firms hold more cash in countries with greater agency problems, where shareholders' rights are not well protected. Further to these results, Pinkowitz, Stulz, and Williamson (2006) show that the value of corporate cash holdings is less in countries with greater agency problems, because of the greater ability of controlling shareholders to extract private benefits from cash holdings in such countries. Dittmar and Mahrt-Smith (2007) investigate how corporate governance impacts firm value, and show that the value of cash is less when agency problems between insiders and outside shareholders are greater. Finally, Harford, Mansi, and Maxwell (2008) provide evidence suggesting that firms with weaker corporate governance structures actually have smaller cash reserves, and weakly controlled managers choose to spend cash quickly on acquisitions and capital expenditures, rather than hoard it.

Empirical evidence related to corporate liquidity demands and optimal holdings of liquid assets has been found. Notably, Opler, Pinkowika, Stulz, and Williamson (1999) examine the determinants and implications of cash holdings and marketable securities by publicly traded U.S. firms. In time-series and cross-section tests, they find evidence supportive of a static trade-off model of liquidity holdings. In particular, they find that firms with strong growth opportunities and riskier cash flows hold relatively more liquidity, while firms with the greatest access to the capital markets tend to hold lower ratios of cash to total non-cash assets. Similarly, Bates, Kahle, and Stulz (2009) systematically examine the potential costs and benefits of holding liquidity. They find that increasing cash ratios are the result of a secular trend rather

than the outcome of the recent build-up in cash holdings of some large firms. They conclude that the precautionary motive for cash holdings plays an important role in explaining the increase in the average cash ratio, where the agency considerations fail to do so.

For international evidence, Pinkowitz and Williamson (2001) examine the cash holdings of firms from the U.S., Germany, and Japan. Ozkan and Ozkan (2004) investigate the empirical determinants of the corporate cash holdings of U.K. firms, where the firms' growth opportunities, cash flows, leverage, and bank debt are found to be important determinants of cash holdings. Instead of using financial statement data to study corporate liquidity, Lins, Servaes, and Tufano (2008) examine corporate liquidity by conducting a comprehensive survey of CFOs for a broad range of both public and private firms from 29 countries. They find that lines of credit are very important liquidity instruments relative to cash holdings, and are strongly related to firms' needs for external financing to fund future investment opportunities.

### **2.2.2 Related Liquidity Studies**

The importance of corporate liquidity demand has been examined in connection with different areas of research. Mikkelsen and Partch (2003) test whether policies of persistent large holdings of cash can predict firms' performances by examining the operating performance and other characteristics. They find that the operating performance of holders of large amounts of liquid assets is greater than the performance of firms matched on size and industry, or with transitory large holdings of cash. Their findings suggest that persistent large liquidity reserves support investment without hindering corporate performance. Similarly, Opler, Pinkowika, Stulz, and Williamson (1999) find no evidence to indicate that firms with large holdings of cash have better operating performance.

Harford, Mikkelsen, and Partch (2004) investigate whether large cash reserves are beneficial in industry downturns. They conclude that, during downturns, liquidity reserves have important effects, providing a beneficial source of internal financing for continued investment, which result in better operating performance and post-downturn sales growth. In connection with market returns, Oler and Picconi (2008) investigate the effect of a firm's deviation from an optimal cash level on contemporaneous and future market returns. They argue that holding more or less than the optimal cash level should have adverse effects on a firm's stock returns. Their results suggest that the market does not fully adjust for a firm's suboptimal cash holdings in the current year, but does adjust in future years as the effects become manifest.

Many studies investigate corporate liquidity holdings in association with typical corporate events such as acquisitions. Harford (1999) finds strong evidence that cash-rich firms are more likely than other firms to attempt acquisitions. In addition, cash-rich firms are more likely to make diversifying acquisitions and their targets are less likely to attract other bidders. By examining stock performance in announcement periods, Harford (1999) shows that returns to unexpected acquisition announcements by cash-rich firms are negative. He concludes that these results are consistent with the predictions of Jensen's (1986) free cash flow hypothesis. As an extension to Harford (1999), Oler (2008) investigates whether the market fully recognises the implications of acquiring firms' liquidity levels, by examining post-acquisition performance. He finds that post-acquisition abnormal stock returns and returns on net operating assets both significantly decrease in acquiring firms' cash levels. In general, Oler (2008) shows that acquisitions where the acquirer has a high cash balance are likely to underperform in the long-run. Pinkowitz (2002) find that the probability a firm will be acquired decreases with liquidity holdings, which suggests that the market for corporate control does not monitor corporate cash holdings.

### 2.2.3 Aggregate Liquidity Considerations

While firm-level corporate liquidity demand and optimal holdings of liquid assets have been explored broadly, much less attention has been given to the corporate liquidity demand at aggregate level. Although firm-level liquidity considerations can generate insights into the various issues discussed above, they cannot capture the movement of liquidity demand for the entire market. Moreover, the consideration of aggregate corporate liquidity demand from the production side of the economy is also very practical. A great deal of the existing literature studying the demand for liquidity has focused on the consumers' (investors') side of the economy.<sup>5</sup> However, due to the nature of an insufficient investor section, liquidity consideration by corporate sector will have stronger predictions. As stated in Eisfeldt and Rampini (2009), firms (production sectors of the economy) may be a more important and quantitatively relevant source of liquidity demand. Additionally, because firms are subject to larger liquidity shocks and rely more heavily on external financing than consumers, they have stronger desires for liquidity.

Theoretical studies by Holmström and Tirole (1996, 1998, 2000, 2001) enlarge our understanding on aggregate liquidity. Holmström and Tirole (1996, 1998) establish a theoretical model on corporate liquidity demand (advanced financing) and link corporate financing problems with the market supply of liquidity, which leads to findings regarding corporate and government liquidity policies. The amount of liquid assets reserved is determined by the trade-off between the costs, if the project is terminated halfway through, and the benefits of a higher initial investment. Moreover, they find that in the presence of pure aggregate uncertainty, whereby the whole aggregate production section faces a liquidity shortage, financial securities that can service corporate liquidity demand can be sold at a *liquidity premium*. Starting with this aggregate liquidity consideration, Holmström and Tirole (2001) explicitly

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<sup>5</sup>See, for example, Diamond and Dybvig (1983), Huang (2003), Allen and Galem (2004), Eisfeldt (2004), Garleanu and Pedersen (2004).

incorporate a costly external finance friction constraint into an equilibrium asset pricing model, and generate a liquidity-based asset pricing model (LAPM). They show that the resulting model, which is affected by aggregate liquidity, can better explain liquidity premium in the capital markets.

Following on the work of Holmström and Tirole (1998, 2001), some researchers started to understand the importance of aggregate liquidity. Greenwood (2005), by constructing aggregate corporate liquidity investment measures, finds strong evidence that, for the corporate sector, aggregate investment in liquid assets as a share of total corporate investment is negatively related to subsequent U.S. stock market returns. He finds that the liquidity investment share, compared to scaled price variables, is a more stable predictor of returns and performs well in out-of-sample predictability tests. The results also support that the aggregate corporate sector actively times security issuance relative to investment needs. Eisfeldt and Rampini (2009) characterise the business-cycle properties of aggregate liquidity, arguing that the use of liquidity to hedge investment opportunities can generate a substantial liquidity premium with empirically observed countercyclical properties.

## 2.3 Market Liquidity Supply

Unlike corporate demand for liquidity, the public provision of liquidity has attracted less attention in the literature. To the best of my knowledge, in relation to liquidity premium, the studies in market liquidity supply all consider the aggregate supply of liquidity by public sector or government. First, it does not make a great deal of sense to consider the supply of liquidity by a single firm. Second, the effects of too much or little liquidity supply can only be realised in the setting of aggregate liquidity. Most related studies are Krishnamurthy and Vissing-Jorgensen (2008) and Sundaresan and Wang (2009), which explore the supply of liquidity at the aggregate level and liquidity premium. Since it is difficult to measure the absolute value of liquidity

premium empirically, each research constructs a different setting to partially capture the liquidity premium and aggregate liquidity supply.

Krishnamurthy and Vissing-Jorgensen (2008) document a strong negative correlation between the U.S. *Debt/GDP* ratio and credit spreads (between corporate bond yields and Treasury bond yields), arguing that this reflects a downward-sloping demand for Treasury debt. In particular, a hypothetical rise in the *Debt/GDP* ratio from its current value of 0.37 to a new value of 0.38 will decrease the spread between corporate bond yields and Treasury bond yields between 1.8bps. They argue that this credit spread reflects a convenience yield (liquidity premium) that investors attribute to Treasury debt. By measuring changes in the supply of Treasury debt, they trace out that the demand for convenience by investors stems from the surety of Treasuries, the superior trading liquidity of Treasuries.

The negative correlation between aggregate liquidity supply and liquidity premium is also suggested in Holmström and Tirole (1998). They systematically investigate the private and public supply of liquidity with a model in which firms have a demand for liquidity. They link the firms' financing problems with the market supply of liquidity and examine the government's role in supplying and managing liquidity. Holmström and Tirole (1998) show that, when there is only aggregate uncertainty, the government can improve welfare by issuing bonds, which should command a liquidity premium over private claims. They suggest that the government should manage debt so that liquidity is loosened when the aggregate liquidity shock is high, and tightened when the liquidity shock is low. Holmström and Tirole (2001), by applying this concept into the asset pricing model, show that the liquidity premium monotonically decreases in the supply of liquidity.

Sundaresan and Wang (2009) focus on the liquidity premium and supply-demand of liquidity ahead of the millennium data change (Y2K), which is viewed as a period of potential aggregate liquidity shortage. Financial institutions around the world expected Y2K to cause an aggregate liquidity shortage. By using the implied volatil-

ities of Y2K options (supplied by the Federal Reserve Bank) and the on/off-the-run spread, they demonstrate that the Fed's action eased the fears of bond dealers, contributing to a drop in the liquidity premium of Treasury securities. More importantly, their analysis suggests a link between the liquidity premium of government debt and the central bank's provision of liquidity, which is obviously consistent with the findings in Holmström and Tirole (2001) about the correlation between liquidity premium and aggregate liquidity supply.

Some related empirical studies have also documented this correlation. Longstaff (2004) examines a flight-to-liquidity premium in Treasury bond prices, by comparing them with the prices of bonds issued by Refcorp, a U.S. government agency. He finds a large liquidity premium in Treasury bonds, which is also related to the amount of Treasury debt available to investors in the market. Greenwood and Vayanos (2008) examine empirically how the maturity structure of government debt affects bond yields and excess returns. They find that the relative supply of long-term government bonds is positively related to the term spread. The positive correlation remains, even after controlling for well-known predictors.

## 2.4 Mergers and Acquisitions (M&A)

Mergers and acquisitions (M&A) is one the biggest research areas in corporate finance. Many interesting phenomena associated with M&A have been recognised over the past fifty years. In general, as summarised in Bouwman, Fuller, and Nain (2009), research on M&A reveals that: takeover activity comes in waves; announcement-day returns are significantly positive for target firms but may be significantly positive or negative for bidding firms; and post-acquisition long-horizon returns to acquiring firms are negative and higher for cash offers and tender offers than for stock offers and mergers.

### 2.4.1 Definitions and Motivations

The M&A market is often referred to as the takeover market, in which acquiring firms compete to take control of the operations of target firms. Essentially, an *acquisition* involves one company taking over another company. A *merger* is one form of corporate acquisition, where two companies decide to combine into a single entity. Companies can grow either via merging their business or a successful tender offer, which is an alternative form of corporate acquisition. A *tender offer* is a bid by one company for a block of another company's outstanding common stock.<sup>6</sup> As stated in Halpern (1983), mergers occur when an acquiring firm and a target firm agree to combine under legal procedures established in the states in which the merger participants are incorporated.

In the vast swathe of literature on M&A, researchers have suggested various motivations for merger activity. I briefly summarise the synergy and agency motives for takeovers.<sup>7</sup> Based on economic rationality, the most important goal for managers is to maximise shareholders' value; managerial takeover activities are expected to increase the wealth of shareholders. In order to achieve this goal, the synergies between both participants in takeovers must be created. Berkovitch and Narayanan (1993) indicate that synergy is the primary motive in value maximisation acquisitions. Synergy, which plays an important role in justifying takeover activity, is defined as the ability to achieve a global value higher than the sum of each company independently. Asquith (1983) finds that target firms have unique resources that provide synergy when combined across firms. Dennis and McConnell (1986) show that mergers are value-creating activities for combined bidding and target firms. Empirical evidences found in these papers are consistent with the synergy hypothesis of mergers.

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<sup>6</sup>A successful tender offer is frequently followed by a merger proposal, while sometimes tender offers may turn into hostile takeovers when the board of directors of the target company does not approve this offer.

<sup>7</sup>There are many other motivations for takeovers in the literature, including the information hypothesis (e.g. Dodd and Ruback (1977)), the hubris hypothesis (e.g. Roll (1986)), etc.



In contrast to maximising the wealth of shareholders, managers' motives to undertake takeovers may be driven by their desires to maximise their own personal interests. Shleifer and Vishny (1988) support that acquisitions are normally the easiest and quickest way for managers to achieve their personal goals. Morck, Shleifer, and Vishny (1990) argue that managers pursue personal benefits from the operation as well as the market value of the firm when companies make acquisitions. Berkovitch and Narayanan (1993) investigate the motives for corporate takeovers and find that agency is the primary motive in takeovers with negative total gains, which are non-value maximisation takeovers.

## **2.4.2 Announcement Effect of Takeovers**

Many previous studies have estimated the effects of takeover announcements on the stock prices of bidding firms and target firms. Research in this field can be classified into several categories based on estimation periods (i.e. pre-announcement, announcement date, and effective date) and estimation targets (i.e. bidding firms, target firms, and combined firms). In general, corporate takeovers generate positive gains inasmuch that the shareholders of target firms benefit generously from M&A and the shareholders of bidding firms break even through takeovers. This section summarises literature mostly related to my research in M&A. Since I mainly consider the effects of merger announcements on acquiring firms surrounding the announcement date, I therefore focus on studies that investigate the returns of bidding firms before and around the announcement date of acquisitions.

### ***A Bidding Firm Returns in Pre-Announcement Period***

Mandelker (1974) shows that bidding firms have positive pre-announcement returns, where cumulative abnormal returns (CAR) start to rise from thirty months prior to the merger. On average, stockholders of acquiring firms earn an abnormal return of

approximately 6% in the thirty months preceding the merger, which suggests that the informational impact of a forthcoming merger took place about thirty months before the effective date. By using a larger sample, Ellert (1976) finds that shareholders of bidding firms earn significantly positive abnormal returns at least four years before the effective date of mergers. In contrast to most of the following research, both studies consider the outcome (effective) date as the event date, instead of using the announcement date.

Taking announcement date as the event date, many papers find consistent results. Dodd and Ruback (1977) estimate the stock market reaction to tender offers, and find that stockholders of bidding firms earn significantly positive abnormal returns for the twelve months prior to tender offers. Asquith (1983) finds that the CAR for both successful and unsuccessful bidding firms over the pre-announcement event window  $(-480, -20)$  are 14.3% and 2.2%, respectively. Schipper and Smith (1983) find that the CAR of acquiring firms starts to increase thirty months before the announcement month. The increase in CAR from month  $-24$  through to the event month is over 20%, with an increase in the year before the acquisitions of about 13.5%. Malatesta (1983) studies the wealth effect of merger activity by measuring abnormal dollar returns and abnormal rates of return. He finds that the cumulative abnormal dollar return for acquiring firms falls by approximately 27.56 million dollars over the five months prior to the announcement date. Based on these results, Malatesta (1983) argues that a merger is a negative net present value project for acquiring firms.

### ***B Bidding Firm Returns in Announcement Period***

Dodd and Ruback (1977) estimate stock market reactions to tender offers, both successful and unsuccessful. They find that in the month of the offer, only successful bidders earn significantly positive abnormal returns. In particular, their evidence shows that shareholders of successful (unsuccessful) bidding firms earn a 2.83% (0.5%) abnormal return in the month of the tender offer announcement. Dodd (1980) inves-

tigates the daily market reaction to the announcement and subsequent acceptance or rejection of merger proposals. In contrast to the abnormal returns to target firms, the evidence indicates a small but significantly negative return to bidding firms.

Asquith (1983) estimates abnormal stock returns throughout the entire merger process for both successful and unsuccessful merger bids. The two-day excess returns are 0.2% for successful acquiring firms and 0.5% for unsuccessful acquiring firms. Asquith, Bruner, and Mullins (1983) find positive (0.9%) and statistically significant ( $t$ -statistic is 4.68) abnormal returns around the announcement date when investigating the wealth effects of merger programmes. Instead of using the market model, Dennis and McConnell (1986) apply the market-adjusted model to calculate abnormal returns. They find insignificant abnormal returns of acquiring firms around the announcement date. In fact, most studies, except for Dodd (1980) and Asquith, Bruner, and Mullins (1983), document that abnormal returns to acquiring firms are not significantly different from zero.

### **2.4.3 Long-term Post-Acquisition Performance**

Parallel to the research on announcement effects, a relatively smaller amount of studies have investigated long-term post-acquisition returns. Previous research shows that the long-term performance of the acquiring firms following acquisitions is mainly negative, and this is a controversial issue. Many papers point out that the efficient market hypothesis (EMH) is rejected when detecting the long-term stock price performance after acquisitions. Jensen and Ruback (1983) comment that: “These post-outcome negative abnormal returns are unsettling because they are inconsistent with market efficiency and suggest that changes in stock prices overestimate the future efficiency gains from mergers.” At this point, I mainly review some notable studies on the post-merger performance of acquiring firms. Research on the performance following tender offers is excluded because I only consider a sample of mergers in

empirical analysis in Chapter 4.<sup>8</sup>

Agrawal and Jaffe (2000) review twenty-two articles that have examined the stock price performance of acquiring firms following acquisitions. They conclude that studies, starting with Franks, Harris, and Titman (1991), show strong evidence of abnormal underperformance following mergers.<sup>9</sup> Agrawal, Jaffe, and Mandelker (1992) find that stockholders of acquiring firms suffer a statistically significant loss of about 10% over five years following mergers; these results are robust after controlling for firm size effect and beta estimation problems. Loderer and Martin (1992) document significantly negative abnormal returns for acquiring firms in the three years following mergers. Using 788 mergers during 1970 and 1989, Loughran and Vijh (1997) find a statistically significant five-year buy-and-hold return of  $-15.9\%$ . By using a larger sample of mergers, Rau and Vermaelen (1998) find a statistically significant three-year abnormal return of  $-4.04\%$ . More recently, Mitchell and Stafford (2000) report that 2,068 acquisitions from 1961 to 1993 deliver a negative value-weighted BHAR of  $-3.80\%$ .

The existence of anomalies following mergers is further supported by empirical evidence found in U.K. companies. When using a sample of 1,800 U.K. takeovers, Franks and Harris (1989) report a significant return of  $-12.6\%$  for two-year post-merger performance. Limmack (1991) finds two-year abnormal returns between  $-4.67\%$  and  $-14.96\%$  under three different models, all of which are statistically significant. Gregory (1997) reports significant negative returns for large U.K. bidders for domestic bidding. Long-run negative returns to shareholders have also been found in cross-border acquisitions (see Eckbo and Thorburn (2000) and Conn, Cosh, Guest, and Hughes (2005)).

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<sup>8</sup>The post-acquisition returns to acquiring shareholders are higher for tender offers. Abnormal returns are predominantly positive, not negative following tender offers. For evidence on tender offers, see Dodd and Ruback (1977), Agrawal, Jaffe, and Mandelker (1992), Loderer and Martin (1992), and Loughran and Vijh (1997).

<sup>9</sup>Studies before Franks, Harris, and Titman (1991) also found evidence consistent with post-acquisition underperformance. See, for example, Langetieg (1978), Firth (1980), Malatesta (1983) and Franks and Harris (1989).

Overall, previous studies in the last two decades of the 20th Century find strong evidence that acquiring firms suffer long-term negative performance following mergers. All together, these studies cover a long time period as well as takeovers in the U.S. and U.K. However, in the meantime, there are some criticisms of long-term return studies in general (see, e.g., Kothari and Warner (1997), Barber and Lyon (1997), Lyon, Barber, and Tsai (1999)), which suggest that something more than the announcement of an acquisition is at work here.

A number of other studies explore potential explanations for post-acquisition anomalies. Rau and Vermaelen (1998) suggest the performance extrapolation hypothesis, which states that both the market and the managers of bidding firms extrapolate its past performance when assessing the value of a new acquisition. They argue that bidding firms with a high book-to-market value (value firms) have significantly higher long-term abnormal returns (5.4%) than firms with a low book-to-market value (glamour firms, only 0.1%), regardless of the method of payment (cash and equity) and type of acquisition (mergers and tender offers). Similarly, results have been reported in Sudarsanam and Mahate (2003) that bidders with high book-to-market value perform more soundly than those with low book-to-market value. Further, some papers even consider the size effect in acquiring firms' long-term performance (see Moeller, Schlingemann, and Stulz (2004)).

#### **2.4.4 Method of Payment**

Loughran and Vijh (1997) is the first to systematically investigate the relationship between post-acquisition returns and the method of payment in acquisitions. They suggest that the method of payment may be related to the target managers' private information about their stock price, which is based on the early work of Myers and Majluf (1984). In a world where managers possess private information that shareholders do not, Myers and Majluf (1984) show that firms tend to issue

stock when their shares are overvalued and pay cash if their stocks are undervalued. Consequently, firms' share prices should drop upon the news of an equity issuance. Loughran and Vijh (1997) therefore suggest that acquiring firms that issue stocks are overvalued, and the stock price should decline following such acquisitions. They report that, during a five-year period following the acquisitions, firms that complete stock mergers earn significantly negative excess returns of  $-25\%$ , whereas firms that complete cash tender offers earn significantly positive excess returns of  $61.7\%$ .

As indicated in Agrawal and Jaffe (2000), the differences between equity and cash financing acquisitions have been examined by several papers before Loughran and Vijh (1997). The following are some examples. Dodds and Quek (1985) report an abnormal return of  $-7.20\%$  in the 60 months following equity-financed acquisitions and a return of  $-4.40\%$  following cash-financed acquisitions over the same time period. Franks, Harris, and Titman (1991) show average post-merger performance over 36 months of  $0.26\%$  per month for cash offers and  $-0.17\%$  per month for equity offers. Gregory (1997) also finds that average abnormal returns are lower for equity-financed acquisitions. Each of these results is consistent with Loughran and Vijh's (1997) predictions that the managers of acquiring firms are likely to choose stock payment when their stock is overvalued and cash payment when it is undervalued.

Besides being used to explain the post-acquisition underperformance of acquiring firms, the method of payment, which is an M&A financing decision, has been analysed widely in the literature. For the announcement effects of M&A, Travlos (1987), Amihud, Lev, and Travlos (1990), Servaes (1991), and Brown and Ryngaert (1991) document significantly negative average announcement returns to acquirers when the method of payment is stock rather than cash.<sup>10</sup> For cross-border acquisitions, Conn, Cosh, Guest, and Hughes (2005) exhibit that the major means of payment in cross-border acquisitions is cash, which is also preferred by the domestic acquisitions of private target firms. Amihud, Lev, and Travlos (1990), Martin (1996), and Ghosh

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<sup>10</sup>See Faccio and Masulis (2005) for a more detailed review on these studies.

and Ruland (1998) empirically investigate the determinants of method of payment and the importance of acquirers' management stockholdings. More recently, Faccio and Masulis (2005) study the M&A payment choices of European bidders for publicly and privately held targets. Consistent with earlier evidence, they find that several deal and target characteristics significantly affect the method of payment choice.

## 2.5 Securities Issuance

This section briefly discusses the securities issuance process, focusing on initial public offerings (IPOs) and seasoned equity offerings (SEOs). An IPO is the means by which a company issues common stocks or shares to the general public for the first time. These transactions are often done by younger companies seeking capital to expand, but can also be done by large privately-owned companies looking to become publicly traded. An SEO is an equity issuing by a firm that is already publicly traded in the markets. In contrast to SEOs, IPOs can be considered unseasoned equity offerings or new issues. In academia and industry, SEOs are also referred to as 'follow-on offerings' or 'secondary offerings', which reflects that SEOs are public equity issues after IPOs.<sup>11</sup>

Instead of providing a thorough analysis on every topic covering securities issuance, which is impossible without a book-length discussion, the purpose of this section is to review empirical anomalies associated with IPOs and SEOs, which are further examined with aggregate liquidity factors in Chapter 5. In particular, notable studies on short-term underpricing, long-term underperformance, and fluctuations in volume and the underpricing of issuances are summarised. As argued earlier, I intend to investigate whether these market anomalies related with equity issuances can be explained by aggregate liquidity. Due to the similarity of IPOs and SEOs, many

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<sup>11</sup>Note that 'secondary offering' is a term that can either mean follow-on offering or shares being sold by existing shareholders, as opposed to a primary offer. In a primary offer, the issuing firm receives proceeds, while in the other case only shareholders receive proceeds.

studies perform analysis without separating them from each other. However, since there are still differences between them, I treat IPOs and SEOs separately in this review, as well as in the empirical analysis. Here, I follow the separation of empirical patterns for IPOs and SEOs in Ritter (2003).

In the literature, three major empirical patterns for IPOs have been documented: (1) short-run underpricing; (2) time-series fluctuations in volume and underpricing; and (3) long-run underperformance. In a review of IPO activity, pricing, and allocations, Ritter and Welch (2002) briefly summarise these patterns with a series of numbers for the U.S. market. These patterns have been the focus of a large group of theoretical and empirical papers.<sup>12</sup> The SEO literature documents four patterns: (1) negative announcement effects; (2) the discounting of offer prices; (3) large fluctuations in volume; and (4) long-run underperformance. An issuing firm that is already publicly traded usually pays additional indirect costs due to negative announcement effects. The other three SEO anomalies are quite similar to those of IPOs, as both offerings exist in the same class of corporate financing activities. However, SEOs usually have lower price uncertainty due to the existence of an active secondary market and trading equities prior to the offering.

Given the burgeoning literature on various aspects of securities issuance, there are many literature reviews on both IPOs and SEOs. For instance, the IPO studies of Ibbotson and Ritter (1995) and Ritter (1998) discuss the process of going public and various explanations for underpricing, and document three empirical patterns (short-run underpricing, hot issue markets, and long-run underperformance). Ritter and Welch (2002), by focusing on more recent literature, review different explanations for patterns in issuing activity, underpricing and long-run performance. Ritter (2003) reviews and analyses the investment banking system and securities issuance

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<sup>12</sup>Some other important aspects in IPOs, like why firms go public, mechanism designs for IPOs, and explanations for underpricing, are also briefly covered in this section. For a detailed discussion on these topics and other IPO issues, please refer to Jenkinson and Ljungqvist (2001), which provides a book-length discussion.



process.<sup>13</sup> Most of this section is devoted to equity issues and evidence from the U.S. market, because equity offerings in the U.S. market are the main focus of my research analysis.<sup>14</sup> As stated in Ritter (2003), capital markets are increasingly globally integrated, and U.S. institutional practices are now more common throughout the world. Note that the terms ‘securities issuance’, ‘equity offers’, ‘equity issuance’ and ‘going public’ are used interchangeably in this review.

### 2.5.1 Motivations for Equity Offers

A central question in equity issuance is: “Why do firms go public?” The conventional wisdom believes that going public can raise equity capital for firms and create a public market in which insiders can cash out at a future date. At certain stages, a company may find it more desirable to go public by selling stocks in markets rather than raising funds from a small number of investors. By going public, a company can raise capital on more favourable terms because of the enhanced liquidity of publicly traded stocks. However, there are some direct and indirect costs that come with these benefits, which affect firms’ decisions on going public. The direct costs of issuing securities are commission fees and underwriting fees. In addition to these, indirect costs include the dilution of shares, underpricing of offer prices, and the negative announcement effect in SEOs; these indirect costs are often much larger than the direct costs.

There are many trade-offs and patterns in equity issuance, but the literature does not have a full theory that can explain the observed pattern of public listings. Ritter (2003) documents that firms seem to face both lifecycle considerations and market-timing considerations in the decision of whether or when to go public. The market-condition considerations consist of time-varying debt versus equity funding

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<sup>13</sup>For other surveys on securities issuance, see Smith (1986), Eckbo and Masulis (1995), Armitage (1998), Brau and Fawcett (2006), and Ljungqvist (2006).

<sup>14</sup>Although these constraints would ordinarily cause some limitations, reviews under such conditions should still sufficiently reflect the existing academic literature.

costs and private versus public funding costs. Academic theory suggests several motivations for going public, which can be classified into pecking order theories, lifecycle theories, and market-timing theories.

Firstly, the pecking order financing theory, together with the trade-off theory, are related to the capital structure literature. The cost of capital literature argues that firms conduct a public offering when external equity will minimise their cost of capital, thereby maximising the value of the company.<sup>15</sup> In the trade-off theory, firms identify optimal leverage by weighing up the marginal costs (bankruptcy and agency costs) and marginal benefits (debt tax shields and a reduction of free cash flow problems) of issuing debt. Based on asymmetric information and stock price misvaluation, Myers and Majluf (1984) and Myers (1984) further advocate for a pecking order model of financing. The costs of issuing risky securities follow the pecking order: firms finance new investments first with retained earnings (internal equity), then with external debt, and finally with external equity. In short, the pecking order model predicts how firms finance themselves and determines capital structures.

The trade-off and pecking order theories are the main theories relating to security issuance and capital structure. Subsequent papers focus on the pecking order model's predictions about security issues (e.g. Shyam-Sunder and Myers (1999) and Fama and French (2002)) and the model's predictions about capital structures (e.g. Titman and Wessels (1988) and Rajan and Zingales (1995)). However, an increasing amount of evidence suggests that the opposite of their predictions is true. The trade-off theory predicts that an increase in a firm's stock price, which effectively lowers its leverage ratio, should lead to debt issuance. Nevertheless, substantial findings suggest that firms issue equity rather than debt when stock prices are high (e.g. Marsh (1982), Jung, Kim, and Stulz (1996), Asquith and Mullins (1986), and Mikkelson and Partch (1986)). The pecking order theory predicts that firms rarely issue stock,

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<sup>15</sup>See, for instance, Modigliani and Miller (1963) and Scott (1976).

which is also rejected by empirical evidence. Fama and French (2005) argue that financing decisions violate the central predictions of the pecking order model, and conclude that both the trade-off model and the pecking order model have serious problems.

Secondly, lifecycle theories may contain corporate control considerations or strategic considerations. Zingales (1995) and Mello and Parsons (2000) argue that an IPO allows insiders (founders and shareholders) to cash out investments. Furthermore, by going public, entrepreneurs thus help facilitate the acquisition of their company for a higher value than what they would get from an outright sale (e.g. Zingales (1995) and Brau, Francis, and Kohers (2003)). Black and Gilson (1998) argue that the entrepreneurs are able to regain control from venture capitalists (VCs), and the VCs have the opportunity to exit through IPOs. Thus, many IPOs serve to benefit entrepreneurs as well as VCs. Chemmanur and Fulghieri (1999) argue that, early in its lifecycle, a firm will be private, but if it grows sufficiently large, it becomes optimal to go public, since public markets may be a cheaper source of funds. Regarding strategic consideration, Maksimovic and Phillips (2001) document that firms may conduct IPOs to capture a first-mover advantage.

Thirdly, the market timing theory in equity issuance is receiving more recognition in the literature. Many recent empirical evidences are found to support the stylised fact that firms issue equity when their stock prices are high. Lucas and McDonald (1990) develop an asymmetric information model that illustrates how firms postpone their equity issues when undervalued. Choe, Masulis, and Nanda (1993) argue that firms avoid issuing in periods when few other good-quality firms issue. In more recent studies, Baker and Wurgler (2002) hypothesise that firms issue equity to “time” the market, i.e. they issue equity when it is overvalued by irrational investors. Such equity issue timing, or “windows of opportunity”, could allow the company to exploit overvaluation profits. Dittmar and Thakor (2007) provide an alternative view by developing a “managerial investment autonomy” theory that predicts the same

stylised fact, because investors have a high propensity to agree with managerial decisions when stock price is high. Another possible explanation is the “time-varying adverse selection”, which suggests that information asymmetry is lower when the firm’s stock price is high.

Empirically, little research exists on the question of why firms decide to go public. This is because researchers cannot observe how many private firms could have gone public, although they can observe the actual firms that did make the decision. Pagano, Panetta, and Zingales (1998) analyse the determinants of IPOs by comparing the *ex ante* and *ex post* characteristics of IPOs with those of private firms. They find that the likelihood of an IPO increases in the firm size and the industry market-to-book ratio. Remarkably, they also find that IPO activity follows high investment and growth. Lerner (1994) documents that industry market-to-book ratios have substantial effects on the decision to go public rather than acquiring additional venture capital financing. Henderson, Jegadeesh, and Weisbach (2006) examine the extent to which firms around the world rely on alternative sources of capital, the locations in which they raise capital, and the factors that affect these choices. They argue that market timing considerations appear to be important in security issuance decisions in most countries. By examining the motivations for public equity offers in an international setting, Kim and Weisbach (2008) find evidence consistent with the view that some equity offers are made to take advantage of high valuations.

## 2.5.2 Initial Public Offerings (IPOs)

### *A Evidence and Reasons for Underpricing*

The best-known pattern associated with initial public offerings (IPOs) is the widely recognised IPO underpricing, which is also known as ‘IPO initial returns’ or ‘first-day returns’. It reflects the price change measured from the offering price to the market closing price on the first trading day. The full extent of underpricing can be realised

by the end of the first trading day in capital markets, without restrictions on daily price volatility.<sup>16</sup> As an alternative to IPO percentage initial returns, academics also like to measure the amounts of “money left on the table”, since this part of the money is actually accrued to investors in IPOs instead of to companies. The money left on the table is defined as the number of shares sold at an IPO, multiplied by the difference between the first-day closing market price and the offer price.

There is a large amount of empirical literature documenting the underpricing phenomenon, the evidence for which provides a puzzle for those who otherwise believe in efficient capital markets. In general, the literature shows that underpricing is a persistent feature of the IPO market and may have increased in magnitude over time. Early notable papers such as Stoll and Curley (1970), Logue (1973), Reilly (1973) and Ibbotson (1975) document that when companies go public, the shares they offer tend to be underpriced, in that the share price jumps substantially on the first day of trading.<sup>17</sup>

Numerous studies have confirmed the new issues underpricing anomaly by using data from the 1970s and 1980s. Smith (1986) summarises a number of papers and finds that the estimated underpricing exists between 11% and 52%. Ibbotson, Sindelar, and Ritter (1988) report that the average underpricing for 2,259 firms in the 1980 to 1984 period is 21%. In addition to these early papers, some of the following studies using U.S. data include Carter and Manaster (1990), James and Wier (1990), Hanley (1993), and Michaely and Shaw (1994). Ibbotson, Sindelar, and Ritter (1994) and Ritter (1998) examine this IPO initial return pattern over a long period. In the U.S. markets, the equally weighted average initial return of 13,308 IPOs from 1960 to 1996 is about 15%. Ritter and Welch (2002) examine the period of 1980 to 2001 and find an average first-day return at about 19%. Moreover, many empirical studies find

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<sup>16</sup>In general, even when using later prices, say the closing price at the end of the first trading week, there are few differences in the underpricing results.

<sup>17</sup>As documented in Ibbotson and Ritter (1995), the literature on IPO underpricing can be traced back to a study in 1963 by the U.S. Securities and Exchange Commission, which finds positive average initial returns on companies going public.

that smaller issues and lower-priced issues are underpriced more than corresponding larger issues and higher-priced issues. Both Chalk and Peavy (1987) and Ibbotson, Sindelar, and Ritter (1994) capture such patterns.

Besides the long-existing IPO underpricing scenario in U.S. markets through time, the phenomenon exists in every nation with a stock market, although the degree of underpricing varies from country to country. Notably, Loughran, Ritter, and Rydqvist (1994) examine the short-run performance of companies going public in twenty-five countries.<sup>18</sup> For instance, various studies include Ritter (1987) and Ibbotson, Sindelar, and Ritter (1994) for the U.S., Levis (1993) for the U.K., Finn and Higham (1988) for Australia, McGuinness (1992) for Hong Kong, Jog and Riding (1987) for Canada, Kim, Krinsky, and Lee (1993) for Korea, and McDonald and Jacquillat (1974) for France. A review of studies on underpricing throughout different countries suggests that the average initial return varies substantially from country to country. These differences in underpricing may be caused by the differences in selling mechanisms and institutional constraints.

In short, empirical studies of IPO initial returns find that (1) underpricing is a persistent feature of the IPO market; (2) the magnitude of underpricing changes through time; and (3) underpricing exists in every nation with a stock market, and the degree varies. Ritter and Welch (2002) document that the IPOs of operating companies are underpriced, on average, in all countries, and the offerings of non-operating companies such as closed-end funds are generally not underpriced. Based on the remarkable and consistent empirical evidence, substantial effort has been devoted to offering possible theoretical explanations for underpricing. Early studies such as Ibbotson (1975) offer a list of possible explanations for underpricing, many of which are formally explored by other authors in later work.

Theories of underpricing can be categorised on the basis of whether asymmetric

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<sup>18</sup>Loughran, Ritter, and Rydqvist update Table 1 of Loughran, Ritter, and Rydqvist (1994) in 2008 and increase the coverage to forty-five countries. The latest table is available on Jay Ritter's website (<http://bear.cba.ufl.edu/ritter/ipodata.html>).

information or symmetric information is assumed.<sup>19</sup> Among most theories, the best established are the asymmetric information models. Different theories give different weights to the three participants in the IPO process: issuers (issuing firms), underwriters (investment bankers) and investors. Table 2.1 summarises the theoretical studies of IPO underpricing explanations and subsequent empirical examinations for different theories. I classify theories on the basis of whether asymmetric information or symmetric information assumption is used. Theories based on asymmetric information can be further classified into four types: (1) Winner’s curse theory (informed investors versus uninformed investors); (2) Information revelation theory (underwriters obtain information from informed investors); (3) Principal-agent theory (issuers are less informed than underwriters); and (4) Signalling theory (issuers are more informed than investors).

Rock’s (1986) winner’s curse theory assumes that some investors are better informed about the true value of the shares than investors in general. Under this assumption, uninformed investors receive a full allocation of overpriced IPOs but only a partial allocation of underpriced IPOs, which means that they are facing a winner’s curse situation. Thus, the uninformed investors will only submit purchase orders if IPOs are underpriced sufficiently enough to compensate for the adverse selection problem. Some studies have attempted to test the winner’s curse model, where evidence is consistent with the existence of a winner’s curse (e.g. Koh and Walter (1989) and Keloharju (1993)). In Rock (1986), underpricing exists due to asymmetric information between informed and uninformed investors. Actually, asymmetric information between the issuers and potential investors, or between the underwriter and the issuer, can also lead to IPO underpricing. Benveniste and Spindt (1989), Benveniste and Spindt (1989), and Spatt and Srivastava (1991) argue that “book-building” allows underwriters to obtain information from informed investors. To

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<sup>19</sup>This is a more general classification, which is applied in Ritter and Welch (2002). Ljungqvist (2006) categorises theories of underpricing into four broad headings: asymmetric information models, institutional explanation, ownership and control, and behavioural explanation.

**Table 2.1: Summary of IPO Underpricing Theories**

This table presents the summary of studies on the explanations for IPO underpricing. The theories of underpricing is categorized on the basis of whether asymmetric information (in Panel A) or symmetric information (in Panel B) is assumed. The first column lists the names of IPO underpricing theories. The second and the fourth column list theoretical and empirical studies, respectively.

Theory	Study	Assumptions & Implications	Empirical Evidence
<b>Panel A: Theories based on Asymmetric Information</b>			
Winner's Curse	Rock (1986)	Some investors are better informed. Uninformed investors must be compensated by underpricing.	Beatty and Ritter (1986), Koh and Walter (1989), Keloharju (1993), Lee, Taylor, and Walter (1999)
Information Revelation	Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), Spatt and Srivastava (1991)	Underpricing awards informed investors for passing valuation information to underwriters.	Hanley (1993), Cornelli and Goldreich (2001, 2003), Jenkinson and Jones (2004)
Principal-Agent	Baron and Holmström (1980), Baron (1982), Loughran and Ritter (2004)	Issuers are less informed than underwriters. It is optimal for the issuer to permit some underpricing.	Muscarella and Vetsuypens (1989), Ljungqvist and Wilhelm (2003)
Signaling Theories	Allen and Faulhaber (1989), Grinblatt and Hwang (1989), Welch (1989)	Issuer is more informed than investors. High-quality issuers attempt to signal their quality with underpricing.	Garfinkel (1993), Jegadeesh, Weinstein, and Welch (1993), Michaely and Shaw (1994), Slovin, Sushka, and Bendeck (1994), Spiess and Pettway (1997)
<b>Panel B: Theories based on Symmetric Information</b>			
Legal Liability	Tinic (1988), Hughes and Thakor (1992), Hensler (1995)	Issuers use underpricing to reduce possible future litigation from investors.	Drake and Vetsuypens (1993), Lowry and Shu (2002)
Prospect Theories	Loughran and Ritter (2002)	Issuers permit underpricing because they gain larger wealth raised in IPOs.	Ljungqvist and Wilhelm (2005)
Price Stabilization	Ruud (1993)	Practice of stabilization by underwriters results in underpricing.	Miller and Reilly (1987), Asquith, Jones, and Kieschnick (1998)
Information Cascades	Welch (1992)	Underpricing induces the first few investors to buy and cause a cascade.	Amihud, Hauser, and Kirsh (2003)



induce truth-telling from investors, underwriters must offer them a combination of more IPO allocations and underpricing. Baron and Holmström (1980) and Baron (1982) suggest a theory with a less informed issuer, but relative to its underwriter, not relative to investors. The issuer may find it optimal to permit some underpricing to induce the underwriter to put in the requisite effort for market shares.<sup>20</sup> The final group of asymmetric information models assumes that issuing firms possess private information about whether they have high or low values (see, e.g., Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989)). If issuers have better information than investors do, underpricing may be used to signal the issuers' high-quality.<sup>21</sup>

There are also a number of theories of underpricing that do not rely on an asymmetric information assumption. Tinic (1988) and Hughes and Thakor (1992) suggest a legal liability theory whereby underpricing may act in the same way as insurance against possible future litigation from investors. Loughran and Ritter (2002) propose a prospect theory for IPO underpricing inasmuch that issuers are satisfied with the amount of money they can raise in IPOs and are not significantly concerned with underpricing. Ruud (1993) argues that the practice of stabilisation by underwriters causes IPO underpricing. The information cascades model is developed in Welch (1992). To prevent investors from not buying, even when in possession of favourable information, issuers may want to underprice and induce cascades in which subsequent investors want to buy, irrespective of their own information. Besides the presented IPO underpricing theories in Table 2.1, some other potential reasons include marketing function (Habib and Ljungqvist (2001)), aftermarket support (Schultz and Zaman (1994)), and ownership considerations.<sup>22</sup>

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<sup>20</sup>Empirical evidence in Muscarella and Vetsuypens (1989) does not quite support this theory.

<sup>21</sup>See Jegadeesh, Weinstein, and Welch (1993) and Michaely and Shaw (1994) for empirical findings.

<sup>22</sup>Readers interested in the underpricing issue should refer to Ljungqvist (2006) for a thorough and up-to-date review on IPO underpricing.

## *B Fluctuations in Volume and Underpricing*

The second anomaly is the fluctuations of IPO volume and underpricing. Periods of high average initial returns are known as “hot issue” markets, which have been recognised for a long time in the financial community.<sup>23</sup> Ibbotson and Jaffe (1975) and many subsequent studies such as Ritter (1984) and Ibbotson, Sindelar, and Ritter (1988, 1994) identify substantial fluctuations in IPO volume, and document significant autocorrelation for both the monthly number of IPOs and monthly average first-day returns. For example, Ritter (1984) show that the first-order autocorrelation coefficient for the time series of monthly average initial returns is 0.62, and is 0.88 for the time series of monthly volume. Loughran and Ritter (2002) report that every month between March 1991 and August 1998 (November 1998 to March 2000) had an average initial return of below (above) 30%. Moreover, both the number of IPOs and the total of proceeds raised varied substantially over time.<sup>24</sup> Helwege and Liang (2004) note that “hot IPO markets have been described as having an unusually high volume of offerings, severe underpricing, frequent over-subscription of offerings, and (at times) concentrations in particular industries ...”.

Puzzling cycles in monthly IPO volume and average initial returns create interesting questions for researchers: Why has IPO underpricing changed over time? Why does IPO volume fluctuate so much? Rational explanations for the existence of hot issue markets are difficult to come by. Ibbotson, Sindelar, and Ritter (1994) survey three explanations for hot issue markets: (1) changes in firm risk; (2) positive feedback or momentum strategies; and (3) windows of opportunity. Ritter (1984) hypothesises that “changing risk composition” might account for the dramatic swings in average initial returns. If there are some periods during which it is riskier for firms to go public, the periods with the riskier firms will have higher average initial

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<sup>23</sup>The best-known investigations of these issues are the Securities and Exchange Commission (SEC) Report on the Special Study of Security Markets (28) and the SEC “hot issue” hearings of 1972.

<sup>24</sup>See Lowry (2003) for detailed analysis.

returns. Loughran and Ritter (2004) empirically examine the changing risk composition explanation and find that only a small part of the increase in underpricing can be attributed to the changing risk composition of firms going public.

While the phenomenon of IPO volume fluctuations has been recognised for a long time, the understanding of these fluctuations is limited. Many researchers attribute time variation in IPO volume to market inefficiency, by arguing that IPO volume is high because firms time the opportunities for issuances when shares are “overvalued” (see, e.g., Ritter (1991), Loughran, Ritter, and Rydqvist (1994), Loughran and Ritter (1995), and Baker and Wurgler (2000)). Notably, Pagano, Panetta, and Zingales (1998) systematically test the relative power of several potential determinants of IPO volume. They argue that companies time their IPOs to take advantage of industry-wide overvaluations. To address why IPO volume fluctuates so much, Lowry (2003) compares the extent to which the aggregate capital demands of private firms, the adverse-selection costs of issuing equity, and the level of investor optimism can explain IPO volume fluctuations. She concludes that firms’ demands for capital and investor sentiment are the primary determinants of changes in IPO volume over time. Pástor and Veronesi (2005) argue that the number of firms going public changes over time in response to time variations in market conditions, which means that IPO volume is more closely related to recent changes in stock prices than to the level of stock prices.

### *C IPOs Long-run Underperformance*

The third pattern associated with IPOs is their poor post-issue stock price performance in the long horizon, which has attracted the most interest from academics in recent years. Using a sample of 1,526 IPOs that went public in the U.S. in the 1975–1984 period, Ritter (1991) finds that, in the three years after going public, these firms significantly underperform against a set of comparable firms matched by size and industry. The average cumulative matching firm-adjusted return after 36

months of offering for the whole sample is  $-29.13\%$ . Ritter (1991) also documents that long-run underperformance is concentrated among firms that went public in the high-volume years, particularly among relatively young firms. The work of Ritter (1991) is a milestone academic study on testing the long-term performance of IPOs. Before this particular work, only Stoll and Curley (1970) and Ibbotson (1975) reported evidence that abnormal returns on IPOs may be negative at some point after going public.

Many of the following papers further support the empirical evidence of IPO long-run underperformance after issues. Loughran (1993) analyses the post-issue long-run performance of 3,656 firms on the Nasdaq from 1967–1987. He reports that the lower returns on Nasdaq firms are primarily a manifestation of the poor performance of IPOs, and the underperformance of Nasdaq-listed IPOs continues for approximately six calendar years after issues. Loughran and Ritter (1995) examine the long-run performance of 4,753 operating firms going public in the U.S. from 1970 to 1990, which are subsequently listed on either the Nasdaq, NYSE, or Amex. They find that firms after IPO significantly underperform relative to non-issuing firms up to five years after the offering date. In particular, the average annual return during the five years after issuing is only 5% per year for firms conducting IPO. A control group of non-issuing firms, matched by firm size, produce larger average annual returns of 12%. Moreover, Loughran and Ritter (1995) document that firms issuing during years with little issuing activity do not underperform, whereas firms offering stock during high-volume periods severely underperform.

Besides U.S. markets, evidence on the long-run performance of IPOs has been found in other international markets. Levis (1993) reports that 721 IPOs in the U.K. (London Stock Exchange) between 1980 and 1988 had average first day returns of 14.3% and underperformed against a number of relevant benchmarks in the 36 months of public listing. For countries in Latin American markets, Aggarwal, Leal, and Hernandez (1993) report that Brazilian, Chilean, and Mexican IPOs suffer

long-run underperformance; the long-run average market-adjusted return is  $-47.0\%$  and  $-23.7\%$  for Brazil and Chile, respectively.<sup>25</sup> Keloharju (1993) documents that seventy-nine Finnish IPOs also underperformed during the 36 months after-issue period. Cai and Wei (1997) provide long-run underperformance evidence of 180 IPOs listed on the Tokyo Stock Exchange in Japan during the period 1971–1992. Chan, Wang, and Wei (2004) study the long-run performance of A- and B-share IPOs issued in China during the 1993–1998 period, and report that A shares only moderately underperform against their benchmarks as compared with IPOs in the U.S., while B-share IPOs significantly outperform their benchmarks.

Although substantial evidences concerning IPO long-run underperformance have been found around the world, intense debates rage regarding the proper measurement technique for a long-term event study, which question the validity of IPO long-run underperformance. Brav and Gompers (1997) show that firms that go public do not perform worse than benchmarks matched on size and book-to-market ratios. In addition, they argue that value weighting IPO returns dramatically reduces the measured underperformance, as a large fraction of IPOs fall in the extreme small growth firm category. Thus, Brav and Gompers (1997) argue that equally-weighted return methods may overstate the underperformance of IPOs. Schultz (2003) suggests a pseudo market timing explanation for IPO underperformance and argues that if more firms go public at peak valuations, event-time analyses may indicate that IPOs underperform, even though the ex ante expectation of these offerings has a zero return. Gompers and Lerner (2003) extend current evidences by examining the performance of IPO firms in the U.S. from 1935 to 1972. They argue that the performance of IPOs in a pre-Nasdaq period depends upon the method of return measurement applied.

To explain the long-run underperformance of IPOs, some studies intend to find explanations from cross-sectional firm characteristics. Brav and Gompers (1997)

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<sup>25</sup>The reliability of these results should be questioned due to the small sample sizes.

investigate the long-run performance of IPO firms in a sample of 934 venture-backed IPOs from 1972–1992 and 3,407 non-venture-backed IPOs from 1975–1992. They find that venture-backed IPOs outperform non-venture-backed IPOs using an equally weighted return. Brav and Gompers (1997) further argue that underperformance is a characteristic of small, low book-to-market firms, regardless of whether they are IPO firms or not. Teoh, Welch, and Wong (1998) examine whether discretionary accruals predict the cross-sectional variation in post-IPO long-run underperformance. They find that issuers with higher discretionary accruals have poorer stock performance in the subsequent three years. Brav, Geczy, and Gompers (2000) examine whether a distinct equity issuer underperformance exists with 4,622 IPOs for the period of 1975–1992. Their evidence suggests that the “anomaly” stock returns following equity issues reflect a more pervasive return pattern in the broader set of publicly-traded companies.

Some studies find that this anomaly pattern for IPO firms in the long-term is not limited to firms going public. Both Weiss (1989) and Peavy (1990) find negative long-run adjusted returns for firms after issuing closed-end funds. Wang, Chan, and Gau (1992) investigate the price performance of the IPOs of Real Estate Investment Trusts (REITs). They find a  $-8.9\%$  CARs during about nine months post-issue. Hertznel, Lemmon, Linck, and Rees (2002) document that publicly listed firms that privately place equity experience positive announcement effects and significantly underperform relative to several benchmarks over the three-year period following the offering. Other than testing the long-run stock performance after IPOs, Jain and Kini (1994) investigate the change in operating performance of firms after IPOs, and find a significant decline in operating performance after offerings.

In general, the evidence for IPO long-run underperformance is widely documented and consistent. Substantial evidence has been found through time for markets in the U.S. and many other countries. Whether long-run underpricing is a unique phenomenon of firms going public or a more generalised pattern of stock markets due

to stock characteristics, no consensus has been made in academic works. Moreover, the degree of underperformance is certainly related to the approaches of empirical measurement and the sample period of data.

### 2.5.3 Seasoned Equity Offerings (SEOs)

#### *A Negative Announcement Effects*

Beginning with Smith (1977), numerous empirical studies have documented that in the U.S. there is a negative announcement for SEOs. This result is consistent with announcement effects for other corporate financing activities.<sup>26</sup> Taking an average of papers written in the mid-1980s, Smith (1986) finds that the two-day average abnormal return (AAR) is  $-3.14\%$  for industrial companies and  $-0.75\%$  for utilities. A more recent review by Eckbo and Masulis (1995) shows very similar results inasmuch that the announcement effects for security offerings, especially for common stock, are negative. Table 2.2 summarises the main findings of the literature on security public offering in the U.S. (NYSE/AMEX).<sup>27</sup> A review of the studies suggests that most of the SEOs in the U.S. proceed via the flotation method of firm commitment underwritten, especially for securities other than common stock. Panel A (Panel B) of Table 2.2 shows major studies that have examined the announcement effects of common stock offerings (straight or convertible bond issuing). Most studies apply a two-day excess return calculation to capture the effect of an announcement.<sup>28</sup>

Asquith and Mullins (1986) and Masulis and Korwar (1986), being among the first main papers, have documented the negative announcement effects for equity

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<sup>26</sup>In general, as firstly documented in Smith (1986), evidence in the literature suggests that corporate actions that use cash have positive announcement effects, and corporate actions that raise cash have negative announcement effects.

<sup>27</sup>This table is analogous to Table 11 in Eckbo and Masulis (1995), but with more emphasis on papers on common stock offerings.

<sup>28</sup>In most cases, the news of security offerings is announced on the day previous ( $t_{-1}$ ) to the announcement date ( $t_0$ ) and reported the next day. Thus, there is a two-day announcement period,  $t_{-1}$  and  $t_0$ .

**Table 2.2: Summary of Security Public Offering Announcement Effects**

This table presents main findings on the announcement effects of security public offering in the U.S. (NYSE, AMEX), classified by type of security issued (common stock, straight or convertible preferred stock or bond), and by type of issuer (industrial firm, public utility). Panel A reports studies on common stock offering only. Panel B report studies on other type of security offering, where method of issues is firm commitment underwritten only. Announcement effect is calculated as two-day (the announcement day and the day prior) abnormal returns to announcements of offerings, which is shown in percentage.

Study	Sample Period	Method of Issues / Type of Security	Industrial Firm		Public Utility	
			Announcement Effect	Sample Size	Announcement Effect	Sample Size
Panel A: Common Stock Offering						
Kolodny and Suhler (1985)	1973-1981	Underwritten	-2.38	(137)	<i>n.a.</i>	
Pettway and Radcliffe (1985)	1973-1980	Mixed	<i>n.a.</i>		-0.51	(366)
Asquith and Mullins (1986)	1963-1981	Underwritten	-3.00	(128)	-0.90	(264)
Hess and Bhagat (1986) <sup>a</sup>	1963-1978	Underwritten	-4.28	(95)	-1.00	(201)
Masulis and Korwar (1986) <sup>a</sup>	1963-1980	Underwritten	-3.25	(388)	-0.68	(584)
Mikkelson and Partch (1986)	1972-1982	Underwritten	-3.56	(80)	<i>n.a.</i>	
Hansen (1988)	1963-1985	Standby Rights	-2.61	(22)	-1.21	(80)
Hansen and Crutchley (1990)	1975-1982	Underwritten	-3.65	(109)	<i>n.a.</i>	
Eckbo and Masulis (1992)	1963-1981	Underwritten	-3.34	(389)	-0.80	(646)
Eckbo and Masulis (1992)	1963-1981	Standby Rights	-1.03	(41)	-0.53	(87)
Eckbo and Masulis (1992)	1963-1981	Rights	-1.39	(26)	0.23	(27)
Choe, Masulis, and Nanda (1993)	1963-1983	Underwritten	-2.42	(669)	-0.52	(787)
Panel B: Other Type of Security						
Dann and Mikkelson (1984)	1970-1979	Convertible Debt	-2.31	(132)	<i>n.a.</i>	
Eckbo (1986)	1964-1981	Straight Debt	-0.37	(150)	<i>n.a.</i>	
		Convertible Debt	-1.90	(53)	-0.13	(140)
Mikkelson and Partch (1986)	1972-1982	Straight Debt	-0.12	(310)	<i>n.a.</i>	
		Preferred Stock	-0.26	(14)	<i>n.a.</i>	
		Convertible Debt	-1.97	(33)	<i>n.a.</i>	
		Straight Debt	-0.23	(171)	<i>n.a.</i>	
Linn and Pinegar (1988)	1962-1984	Preferred Stock	-1.30	(14)	0.18	(201)
		Convertible Debt	-2.02	(42)	-1.39	(8)
Hansen and Crutchley (1990)	1975-1982	Convertible Debt	-1.45	(67)	<i>n.a.</i>	
		Straight Debt	0.11	(188)	<i>n.a.</i>	

<sup>a</sup> Announcement effect is calculation use the announcement date and the day after.



public offerings.<sup>29</sup> Asquith and Mullins (1986) find  $-3.00\%$  and  $-0.90\%$  abnormal returns for industrial firms and utility firms, respectively. Similarly, Masulis and Korwar (1986) also find negative announcement effects for industrial firms ( $-3.25\%$ ) and smaller returns for utilities ( $-0.68\%$ ). The negative announcement effects of common stock issues via firm commitment underwritten is further confirmed in Hess and Bhagat (1986), Eckbo and Masulis (1992) and Choe, Masulis, and Nanda (1993). Through different method, Officer and Smith (1986) and Mikkelsen and Partch (1988) support the negative announcement effect by reporting that common stock offer cancellations are associated with a significantly positive announcement effect of slightly smaller magnitude than the negative effect for an equity issue announcement. While the negative price impact of SEO announcements for U.S. markets is widely documented, the results for debt issues are inconsistent. There are no significant negative price impacts from straight debt issue announcements.<sup>30</sup> However, some previous papers found that public offers of convertible debt are associated with significantly negative announcement effects.

Why is there a negative announcement effect for seasoned equity offerings? The leading explanation among academics is Myers and Majluf's (1984) *adverse selection model*.<sup>31</sup> Myers and Majluf (1984) assumes that companies know more about themselves than the market, and managers want to maximise the wealth of their existing shareholders. At any point in time, due to information asymmetry, the current market price may be too high or too low relative to managers' private information about the value of assets in place.<sup>32</sup> Rational investors will interpret an equity offering announcement as conveying a manager's opinion that the stock is overvalued, and the

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<sup>29</sup>Some early studies such as Smith (1977), Marsh (1979), and Hess and Frost (1982) generally find a small price reduction in the period surrounding the equity issues.

<sup>30</sup>See, for example, Eckbo (1986), Mikkelsen and Partch (1986), and Hansen and Crutchley (1990).

<sup>31</sup>Krasker (1986) generalises Myers and Majluf's model and reach similar predictions.

<sup>32</sup>If managers believe that the current market price is undervalued, the firm will not issue undervalued stock. In such a case, the existing shareholders lose out because some of the future gain from being undervalued is shared by new investors. On the other hand, if managers think that the current stock price is overvalued, the firm will issue equity if debt financing is not available.

announcement effect is negative. Empirical evidence in SEO announcement effects is largely consistent with the adverse selection theory. Security public offerings have non-positive announcement effects, regardless of the type of security and average 3% negative effects for equity issues. The average market reaction to common stock issues is more negative for larger sized issues. Moreover, the market reaction to SEOs is less negative for uninsured rights than for rights with standby underwriting (see Eckbo and Masulis (1992)) and less negative for public utility issues (see Eckbo and Masulis (1995)).

When a firm raises external equity capital, it not only suggests that management might have private information about the “true” value of the firm, but also that something will be done with the funds raised. If the market interprets the issue announcement as implying that a new positive new present value project will be undertaken, the announcement effect could be positive. Cooney and Kalay (1993) refines Myers and Majluf’s model by (realistically) allowing for the possibility that the project can have either a positive or a negative net present value (NPV). This result is consistent with some empirical studies that have found an overall positive announcement return for private equity issues (e.g. Wruck (1989) and Hertz and Smith (1993)). An alternative asymmetric information model is proposed by Miller and Rock (1985), who argue that an unexpected security issue implies that future cash flows are less than expected. From this point of view, the security offer announcement decreases the issuer’s market price, regardless of the direction of the implied leverage change.

In summary, three patterns align with SEO announcement effects. First, the announcement effect for a common stock offering is significantly negative and larger than those for other types of security offering. Second, industrial firms have a stronger negative announcement effect than public utilities. Third, debt issues cause an insignificant market reaction unless there are increases in the potential amount of outstanding common stock. Overall, and similar to the findings in Eckbo and Ma-

sulis (1995), the market reaction to public offers is significantly different from zero, but only when the financing decision increases the potential amount of outstanding common stock.

### ***B SEO Discounting and Explanations***

While IPO underpricing has attracted extensive attention in the literature, SEO discounting has attracted far less. Smith (1977), to my knowledge, was the first to document significant discounting for SEOs. Smith (1977) reports average close-to-offer returns (offer-to-close returns) of  $-0.54\%$  ( $0.82\%$ ) from a sample of 328 firm-commitment offers over the years 1971 to 1975. The concepts of SEO discounting and SEO underpricing are very similar; many studies even use both terms interchangeably. Similar to IPOs, an SEO is applied to measure the discounting of the offer price to the market price in equity offers. However, in the case of SEOs, there is already a market price before issues. To clarify the differences between the two definitions, an SEO discount is calculated as the return from the closing price of stock the day prior to the offer date to the offer price (close-to-offer). SEO underpricing is measured as the return from the offer price to the closing price on the offer date (offer-to-close).

In general, the discounting of offer prices in firm underwritten SEOs is economically large and common, remaining stable at around  $3.0\%$  throughout the 1990s (see Altinkılıç and Hansen (2003)). Subsequent studies further support the findings in Smith (1977), many of which examine SEO announcement effects. Bhagat and Frost (1986) examine issues by public utilities and report a significant discounting of  $-0.25\%$  for negotiated underwritten issues and  $-0.65\%$  for competitive underwritten issues. Eckbo and Masulis (1992) report mean discounting of  $0.44\%$  for issues by industrial firms and offer price premium of  $0.31\%$  for offers by public utilities. Eckbo and Masulis (1992) also find premiums in SEO underpricing for both industrial ( $0.11$ ) and utility ( $0.06$ ) issues, which means the closing price on the offer day

is lower than the offer price. Loderer, Sheehan, and Kadlec (1991) compare 1,600 SEO pricing across markets. In their sample, they report statistically significant discounting of 1.41% and underpricing of 0.35%. Moreover, classified by markets, they report statistically significant discounting of  $-2.96\%$  and underpricing of  $-1.62\%$  for issuers listed on Nasdaq, but no apparent underpricing for NYSE-listed issuers. They conclude that existing IPO underpricing models cannot be easily adopted to explain the observed differences in SEO pricing across exchanges and industries.

Three more recent studies examine the pricing of SEOs in the 1990s. Altinkılıç and Hansen (2003) partition discounting into its expected and unexpected components and examine the relation between these components and stock returns. They find that discounting is higher for issuers with lower stock prices and for those with greater stock return volatility, and discounting is less for banks with better reputations. Similar to Loderer, Sheehan, and Kadlec (1991), they also find that equity offers by Nasdaq firms experience larger discounting than NYSE/Amex firms. Mola and Loughran (2004) find that the average offering of new equity has a 3% discounting and the discount has risen steadily over time. They also find evidence of the increased clustering of offer prices at integers and conclude that clustering is a significant determinant of SEO discounting. Notably, Corwin (2003) provides a comprehensive analysis of the determinants of seasoned offer pricing. Using a large sample of SEOs from 1980 through to 1998, Corwin (2003) examines the relative importance of various hypotheses in explaining the cross-section of SEO discounting. Corwin finds that discounting is positively related to offer size, price uncertainty, and underwriter pricing conventions.

### *C SEOs Long-run Underperformance*

Similar to IPOs, firms conducting SEOs typically suffer a long-run underperformance of equity for up to five years. Many studies find that the negative post-issue performance of SEOs is related with high positive returns in the years before issuing.

Loughran and Ritter (1995) show that the average annual return for 3,702 SEOs during 1970 to 1990 is only 7% five years after the issues, while the return for a matching portfolio is 15.3%. They also report that in the year prior to the offerings, the average issuer experiences a return of 72%. Loughran and Ritter (1995) thus conclude that firms conducting SEOs underperform as severely as IPO firms, and firms take advantage of windows of opportunity by issuing equity when they are substantially overvalued. A concurrent paper by Spiess and Affleck-Graves (1995) examines the long-run stock returns following SEOs with a sample of 1,247 issues during the period 1975–1989. They argue that SEO firms substantially underperform in a sample of industry- and size-matched firms. A three (five)-year buy-and-hold investment strategy in SEO firms at the closing pricing of the issuing day would leave the investor with only 85.4 (78.6) cents relative to each dollar from investment in matched firms. Similar to evidence in IPOs, Spiess and Affleck-Graves (1999) also argue that SEO underperformance is significantly more severe for the smallest, youngest, and Nasdaq-listed firms, and those with the lowest book-to-market ratio.

International evidence on SEO long-run performance, although limited, is consistent with that relating to the U.S. market. Evidence in the U.K. is documented by Levis (1995), who argues that SEO firms are preceded by positive average abnormal returns in the 12 months before the announcement, and followed by statistically significant negative performance in the 18 months after the announcement. Caia and Loughran (1998) investigate the long-run stock and operating performance of 1,389 SEOs listed on the Tokyo Stock Exchange (TSE) in Japan during 1971 and 1992. They find that an equally weighted portfolio of SEO firms generates a three-year buy-and-hold return of 34% compared to 52% from firm size-matched portfolio. Jeanneret (2005) examines the long-run stock performance of French SEOs, separating SEO samples with the intended use of the proceeds into “financing new investment” issuers and “capital structure” issuers, and finds abnormal underperformance only for SEO firms that intend to finance investment with raised funds.

Although the underperformance of SEO firms in the long-run are widely and consistently documented, the conclusions regarding abnormal underperformance are hotly debated and sensitive to the methodology applied. Eckbo, Masulis, and Norli (2000), with a sample exceeding seven thousand seasoned equity and debt offerings from 1964–1995, argue that the failure of the matched-firm technique rather than market under-reaction to SEO announcements creates a pattern of long-run underperformance for SEO firms. Specifically, the issuer’s underperformance reflects lower systematic risk exposure for issuing firms relative to matched firms. Brav, Geczy, and Gompers (2000) examine whether a distinct seasoned equity issuer underperformance exists with 4,526 SEOs from 1975–1992. They document that long-run underperformance is concentrated primarily in small firms with low book-to-market values, and is a replication of a common stock return pattern in the market. Jegadeesh (2000) finds supporting evidence for the long-run underperformance of SEOs and argues that the results are sensitive to the construction of benchmarks and measurement approaches.

Besides the seasoned offering of common stocks, the issuing of other securities has been examined in many studies. Lee and Loughran (1998), using a sample of 986 convertible bond issuers from U.S. operating firms during 1975 and 1990, find poor stock and operating long-run performance. Spiess and Affleck-Graves (1999) examine the long-run post-issue underperformance of firms making straight and convertible debt offerings from 1975 to 1989. Similar to many IPO findings, they determine that long-run underperformance is more severe for smaller, younger and Nasdaq-listed firms, and that it is highly related to the volume of aggregate issues. Foerster and Karolyi (2000) investigate the long-run performance of non-U.S. firms that raise equity capital in U.S. markets through American Depositary Receipts (ADRs). They find that the sample of 333 global equity offerings underperform against benchmarks by 8 to 15 per cent over the three-year post-issue period.

## 2.6 Asset Sales and Corporate Divestitures

There is a large and active market for corporate assets, from individual plants and divisions up to sales of entire corporations (liquidation). As reported in Maksimovic and Phillips (2001), each year over the period 1974 to 1992, an average 3.89 percent of the large manufacturing plants in the U.S. changed ownership. In expansion years, an average of 6.19 percent of manufacturing plants are involved in mergers and acquisitions and asset sales every year. While much of the research in the literature has been devoted to investigating mergers and acquisitions (M&A), far less is known about partial-firm asset sales.<sup>33</sup> By the early 1980s, although substantial evidence had been found in M&A, no such abundance of research exists on corporate asset divestitures. Early studies between 1983 to 1987 examined the valuation effects of asset sales announcements. The following studies are devoted to exploring the motivations behind asset sales and determinations for the different performances of divesting firms.

### 2.6.1 Definition of Asset Sales

Asset sales (also known as corporate divestitures) represent the sale of a segment of a company to a third party. Operating assets, productive asset portfolios, subsidiaries, or divisions are sold for cash, securities, or some combination thereof. Corporate divestitures are very closely related to mergers and acquisitions (M&A). In practice, corporate divestitures accounted for about 40% of acquisition activities in the 1980s. Divestitures in the 1990s ran at about 35% of the dollar value of acquisition transactions (See Weston, Mitchell, and Mulherin (2003), p347). In the research literature, corporate divestitures can be considered as financing solutions for liquidity or future acquisition, and viewed as partial mergers (See Jain (1985)).

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<sup>33</sup>See Jensen and Ruback (1983) and Agrawal and Jaffe (2000) for comprehensive surveys on corporate takeovers.

Corporate divestitures can be categorised as either *sell-offs* or *spin-offs*. Early research, such as that undertaken by Alexander, Benson, and Kampmeyer (1984) and Miles and Rosenfeld (1983), used this kind of classification.<sup>34</sup> Sell-offs are defined as the selling of some of the assets of a parent firm, such as a subsidiary, division, or product line, while the firm continues to exist in essentially the same form as that prior to the sell-off. The divested assets are purchased and become part of another firm. Payment is generally in the form of cash and securities. In Hite, Owers, and Rogers (1987), similarly, a sell-off is defined as the sale of a subsidiary, division, or other operating asset to a buyer for cash, securities, and/or other future consideration. The seller acquires liquid assets that may be used to buy operating assets, retire debt or stock, or pay dividends. Spin-offs, in comparison, are often associated with controlled subsidiaries, and occur when a company distributes all of the common shares it owns in a controlled subsidiary to its existing shareholders. In spin-offs, no money changes hands, and the subsidiary's assets are not revalued. Moreover, corporate divestitures (whether sell-offs or spin-offs) may occur *voluntarily* or *involuntarily*.<sup>35</sup> Based on the above descriptions, corporate divestitures can be classified as one of the following four types: voluntary sell-offs, voluntary spin-offs, involuntary sell-offs, and involuntary spin-offs.

In this research, *asset sales (or corporate divestitures) precisely means voluntary corporate sell-offs*. The main focus is the financing aspect of asset sales when firms are facing liquidity problems. Voluntary sell-offs generate liquid assets (cash or liquid assets) in the transactions of asset sales for sellers. Moreover, they can be viewed as positive actions taken by companies to tackle liquidity problems. However, in spin-offs, there are no buyers and no cash flow implications per se. In involuntary

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<sup>34</sup>The following definitions of sell-offs and spin-offs mainly follow the descriptions in Alexander, Benson, and Kampmeyer (1984) and Miles and Rosenfeld (1983).

<sup>35</sup>Voluntary divestitures can be viewed as the result of decisions made willingly by management for the benefit of the stockholders of the parent firm. Involuntary divestitures are typically due to a governmental anti-trust ruling issued by either the Federal Trade Commission or the U.S. Department of Justice in connection with a violation of Section 7 of the Clayton Act.



divestitures, the activities are more likely due to the anti-trust behaviours of firms and are passivity forced by governments. In this case, voluntary sell-offs are closer to the definition for asset sales. Actually, many studies do not specially differentiate between asset sales, corporate divestitures, and corporate sell-offs. Therefore, for convenience, I use expressions like ‘asset sales’, ‘divestitures’, and ‘sell-offs’ interchangeably.

## 2.6.2 Valuation Effects of Divestiture Announcements

Substantial research was undertaken in the 1980s on asset sales, takeovers, and other corporate activities. Most research, in that time, expanded our understanding about the association of these corporate decisions with the welfare of the stockholders involved in these transactions. In particular, for asset sales, many studies investigated the effect on shareholder wealth of the announcement by management of an investment decision to voluntarily sell assets to other firms. Previous studies investigating the announcement effects of corporate divestitures have reached a number of conclusions.<sup>36</sup> For asset sales, empirical evidence suggests that announcement days are associated with a positive stock price reaction. In pre- and post-announcement periods, share prices exhibit mixed (i.e. positive, negative or zero) performance. Conversely, empirical studies on spin-offs have produced more uniform results, whereby positive abnormal returns in announcement periods have been found.

### *A Asset Sales Announcement*

While substantial work has been expended in M&A, limited efforts were dedicated to the related subject of corporate divestiture until Boudreaux (1975). Boudreaux (1975) finds a positive stock price effect for sell-offs and spin-offs together for the

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<sup>36</sup>For empirical evidence on asset sales, see Alexander, Benson, and Kampmeyer (1984), Boudreaux (1975), Hearth and Zaima (1984), Jain (1985), Klein (1986), Rosenfeld (1984), and Zaima and Hearth (1985). For research on corporate spin-offs, see Hite and Owers (1983), Linn and Rozeff (1985), Miles and Rosenfeld (1983), and Schipper and Smith (1983).

divesting firms up to three months around the event date in the period 1965–1970. However, he did not distinguish between sell-offs and spin-offs, and did not perform statistical significance tests in analysing the behaviour of stock returns. Table 2.3 contains a summary of some of the more important previous empirical studies on voluntary sell-offs in Panel A, and on voluntary spin-offs in Panel B.<sup>37</sup> It is noteworthy that all the papers listed in Table 2.3 are from between 1984 and 1987, which is quite a concentrated period for testing corporate divestiture announcement effects. Although there are some other papers in the literature from this period (see Hearth and Zaima (1984), Linn and Rozeff (1985), and Zaima and Hearth (1985)), I chose not to discuss them in detail as they all reach similar results and their impact on subsequent studies is relatively small.

As previously noted, announcement day effects for the selling firms are associated with positive stock reaction. However, there are still some substantial variations across studies. Alexander, Benson, and Kampmeyer (1984) examine a sample of 53 firms and find positive, but not significant, excess returns (only 0.17%). They also find that sell-offs appear to be announced after a period of generally negative abnormal returns.<sup>38</sup> Jain (1985) extends the work of Alexander, Benson, and Kampmeyer (1984) by using a much larger sample, which contains over 1,000 first publicly available sell-off announcements. He reports significant positive excess returns around the sell-off announcements, and significant negative pre-event returns for asset sellers. Instead of just considering corporate sell-off announcements, Rosenfeld (1984) estimates the effect of voluntary divestiture (sell-off or spin-off) announcements on shareholder wealth. He finds that both sell-off and spin-off announcements tend to have a positive influence on the stock prices of the divesting firms. He also finds that the spin-offs “outperform” the sell-offs (5.56% against 2.33%) over the announce-

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<sup>37</sup>Klein (1986), in the end of his paper, also provides a similar table as a summary of studies on voluntary sell-offs, although he did not include studies on voluntary spin-offs.

<sup>38</sup>The weak announcement effects in Alexander, Benson, and Kampmeyer (1984) could be due to the small sample size.

**Table 2.3: Summary of Empirical Studies on Divestiture Announcement Effects**

This table presents summary of empirical studies on the announcement effects of corporate divestiture. Panel A and Panel B reports studies on voluntary sell-offs and spin-offs, respectively. The results shown in the table is the cumulative abnormal returns (CARs), which is calculated by using either mean-adjusted model or market model. Day 0 of an event window is the announcement date of sell-offs or spin-offs. *t*-statistics are reported in parentheses.

Study	Methodology <sup>1</sup>	Sample Size	Sample Period	Announcement Day CAR	Pre-Announcement Day CAR	Post-Announcement Day CAR
<b>Panel A: Voluntary Sell-Offs</b>						
Alexander, Benson, and Kampmeyer (1984) <sup>a</sup>	MAR	53	1964–1973	+0.17% (0.68)	−2.54% (−1.67)	−2.47% (−1.16)
Hite, Owers, and Rogers (1987) <sup>b</sup>	MM	55	1963–1978	+1.66% (4.08)	+0.69% (0.51)	n.a
Jain (1985) <sup>c</sup>	MM	1107	1976–1978	+0.70% (4.04)	−2.20% (−4.29)	−0.60% (−1.13)
Klein (1986) <sup>d</sup>	MM	215	1970–1979	+1.12% (2.83)	+1.84% (1.81)	+1.29% (1.31)
Rosenfeld (1984) <sup>e</sup>	MAR	62	1969–1981	+2.33% (−4.60)	−0.92% (−0.61)	+1.41% (0.93)
<b>Panel B: Voluntary Spin-Offs</b>						
Hite and Owers (1983) <sup>f</sup>	MM	123	1962–1981	+3.30% (13.25)	+7.30 (4.28)	n.a
Miles and Rosenfeld (1983) <sup>g</sup>	MAR	92	1963–1980	+3.34% (6.55)	+5.96% (2.33)	+1.11% (0.43)
Rosenfeld (1984) <sup>e</sup>	MAR	93	1963–1981	+5.56% (8.42)	−1.29% (−0.62)	−2.10% (−1.00)
Schipper and Smith (1983) <sup>h</sup>	MM	93	1963–1981	+2.84% (6.61)	−0.67% (−0.23)	−1.97% (−1.03)

<sup>1</sup> MAR = Mean-Adjusted Returns Model; MM = Market Model (or Single-Index Model).

<sup>a</sup> Event windows defined as days (−1, 0), days (−30, −2), and days (+1, +30) respectively.

<sup>b</sup> Event windows defined as days (−1, 0) and days (−50, −5) respectively.

<sup>c</sup> Event windows defined as days (−5, −1), days (−60, −11), and days (+11, +60) respectively.

<sup>d</sup> Event windows defined as days (−2, 0), days (−40, −3), and days (+1, +40) respectively.

<sup>e</sup> Event windows defined as days (−1, 0), days (−30, −11), and days (+11, +30) respectively.

<sup>f</sup> Event windows defined as days (−1, 0) and days (−50, 0) respectively.

<sup>g</sup> Event windows defined as days (0, +1), days (−60, −11), and days (+11, +60) respectively.

<sup>h</sup> Event windows defined as days (−1, 0), days (−90, −2), and days (+1, +40) respectively.

ment period, which suggests that the announcement effect of spin-offs has a stronger positive influence on share prices than sell-offs.

Later studies of asset sales all provide further evidence supporting the previous evidence that, on average, initial announcements of asset sales result in significantly positive excess returns. Meanwhile, they try to find determining factors of announcement effects, since not all divestiture announcements are accompanied by positive price movements. In particular, these papers examine differences in announcement day effects among firms engaged in voluntary sell-offs. By separating samples based on whether the transaction price is announced, Klein (1986) finds that the announcement day effect is significantly positive for the price group, but not statistically different from zero for the no-price group. He also finds a positive relation between announcement day returns and the relative size of the divestiture. Hite, Owers, and Rogers (1987) find that, on average, the initial announcements of sell-offs generate an increase of 1.5% on selling firms' market values. They also find positive abnormal returns of 1.66% for successful sellers and 1.41% for unsuccessful sellers.

### ***B Spin-offs Announcement***

The results for voluntary corporate spin-offs are more consistent. Like asset sales, the announcement of spin-offs is found to have positive abnormal returns. In contrast to asset sales, pre-announcement abnormal returns are positive for spin-offs. Miles and Rosenfeld (1983) report that spin-off announcements enhance shareholder wealth, and that these announcements usually follow a period of positive abnormal returns. They also argue that large spin-offs have a greater positive influence on equity values than on small spin-offs. Schipper and Smith (1983) also document a significant positive share price reaction of 2.84% for voluntary spin-off announcements, and suggest the gains to shareholders may arise from tax and regulatory advantages. Hite and Owers (1983) conclude that, over the entire event period, positive gains for firms engaging in spin-offs facilitate mergers or separate diverse operating units.

They also report positive average excess returns for all groups over the two-day interval around the first announcement.

Most of the papers discussed above focus on just one type of corporate event, either an asset sell-off or a spin-off. Slovin, Sushka, and Ferraro (1995) examine the valuation effects on firms in the same industry as entities that are subject to carve-outs (initial public offerings of subsidiary equity), spin-offs, and asset sell-offs. They find that share price reactions for rivals are negative in response to equity carve-outs. In comparison, rival stock returns are positive for spin-offs and normal for asset sell-offs. Parent firms earn positive returns in response to carve-outs, spin-offs, and sell-offs, while the rivals of parent firms earn normal returns in each case.

### **2.6.3 Motivations for Asset Sales**

Corporate sell-offs, like mergers and acquisitions (M&A), are informative economic events. One important difference between acquisitions and sell-offs appears to be that sell-offs are usually initiated by the sellers, whereas takeover attempts are usually initiated by the bidders (buyers). Moreover, unlike M&A, the theoretical and empirical studies advanced to explain the motivations for asset sales and the announcement effects on stockholders are relatively limited to the 1980s and early 1990s. Hite, Owers, and Rogers (1987) argue that corporate sell-offs can represent partial acquisitions from the buyer's perspective, and expect them to have much in common with motivations for mergers and acquisitions. By examining both successful and unsuccessful asset sell-off proposals, Hite, Owers, and Rogers (1987) apply the information hypothesis and synergy hypothesis from Bradley, Desai, and Kim (1983) to partial asset sell-offs, in order to explore the motives for asset sales. They find that the gains of asset sales accumulate to successful sellers and bidders, which supports the synergy hypothesis proposed by Bradley, Desai, and Kim (1983) for inter-firm tender offers.

In general, there are many motives for corporate asset sales such as dismantling conglomerates, changing strategies or restructuring, selling into a better fit company, discarding unwanted businesses from prior acquisitions, corporate financing, additional investment required, etc. The finance literature has identified several reasons for corporate divestitures. Following Schlingemann, Stulz, and Walkling (2002), I chose to discuss the following three prominent reasons in detail:

1. relax credit constraints or finance investments — *financing explanation*.
2. have specific assets operated by those who can operate them most efficiently — *efficiency explanation*;
3. make the firm more efficient by reducing its degree of diversification — *focusing explanation*;

### ***A The Financing Explanation***

One of the most important explanations for asset sales focuses on sell-offs as a source of liquid assets for firms. Hite, Owers, and Rogers (1987) argue that, in several cases, management indicated that assets were being sold to raise capital for the expansion of existing lines of business or to reduce high levels of debt. In other words, *asset sales can be viewed as an alternative to the sale (issue) of new securities*. Compared with public equity offerings, there are some advantages for firms choosing to finance through asset sales.<sup>39</sup> First, direct sales of assets to another firm lower the costs of asymmetric information in public equity offerings, which means informational asymmetries may be less important for the asset the firm wants to sell than for the firm as a whole. When market investors buy only small fractions of a new equity issue, they have less incentive to become informed than the managers of the acquiring corporation in an asset sale. The acquiring management could also be expected to

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<sup>39</sup>Some of these reasons are shown in Lang, Poulsen, and Stulz (1995).

have a comparative advantage in valuing the target assets compared with investors valuing new equity claims on the firm's overall operations.

Second, if the firm's debt overhang is large, selling an asset may avoid the recapitalisation costs that would have to be paid to raise funds on the capital markets. Third, if management pursues its own objectives, selling an asset provides funds with potentially fewer restrictions on managerial discretion. Fourth, empirical evidences by Mikkelsen and Partch (1986), Asquith and Mullins (1986), Masulis and Korwar (1986), and Eckbo (1986) suggest that stock prices generally react non-positively to the announcement of a new security offering. Existing empirical evidences by Alexander, Benson, and Kampmeyer (1984), Jain (1985) and Hite, Owers, and Rogers (1987) show that asset sale announcements are associated with positive stock price reactions, where these gains mostly accumulate to asset-divesting firms. Therefore, firms raising liquidity through the sales of assets can avoid negative market reaction on their valuation.

One of the important papers in this area is Lang, Poulsen, and Stulz (1995). The authors advance a more compelling motivation to sell assets — that asset sales provide funds when alternative sources of financing are too expensive,<sup>40</sup> otherwise known as the *financing hypothesis of asset sales*. The main empirical results are consistent with the financing hypothesis rather than with the efficient deployment hypothesis inasmuch that: firstly, firms selling assets tend to be poor performers and have high leverage, which means that a typical firm selling assets is motivated to do so by its financial situation; and secondly, the stock price reaction to successful asset sales is strongly related to *use of the proceeds*. In short, Lang, Poulsen, and Stulz (1995) find that stock price reactions on asset sale announcements are significantly positive, but only for those firms that plan to pay out the proceeds, which is strongly consistent with the financing hypothesis. Since Lang, Poulsen, and Stulz (1995),

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<sup>40</sup>This is possibly because of agency costs of issuing debt or because of information asymmetries in market equity offerings.

some research has explored the use of proceeds generated from asset sales, such as Bates (2005) and Lee and Lin (2008). Bates (2005) examines the allocation of cash proceeds following subsidiary sales. He finds that retention probabilities increase in the divesting firms' contemporaneous growth opportunities and expected investment. The results, he finds, cohere with the trade-off between the investment efficiencies associated with retained proceeds and the agency costs of managerial discretion and debt.

Research by Shleifer and Vishny (1992) and Brown, James, and Mooradian (1994) stresses the importance of asset sales as a way of resolving financial distress. Shleifer and Vishny (1992) find that when a firm in financial distress needs to sell assets to gain liquidity, its industry peers are likely to experience problems themselves, leading to asset sales at prices below value in best use. This finding is consistent with empirical evidence in Officer (2007). Officer (2007) realises acquisition discounts for subsidiaries of other firms relative to acquisition multiples for comparable publicly-traded targets. Corporate divesting firms are significantly liquidity-constrained prior to the sale of a subsidiary, particularly when the subsidiary is being sold for cash. He also finds that acquisition discounts are significantly greater when debt capital (other financing sources) is relatively more expensive to obtain. Brown, James, and Mooradian (1994) find that creditor pressure, particularly from short-term senior lenders, plays a pivotal role in the decision to liquidate assets, and determines how sales proceeds are used. A related study by Schlingemann, Stulz, and Walkling (2002) argues that the liquidity of the market for corporate assets plays an important role in the process of asset sales. Firms are more likely to divest segments from industries with a more liquid market for corporate assets.

### ***B The Efficiency Explanation***

Hite, Owers, and Rogers (1987) emphasise *the efficiency explanation* as the motive for asset sales. They find that announcements of asset sell-off are associated with



positive stock price performance for selling firms, and mostly for successful sellers. Unsuccessful asset sellers experience positive abnormal returns at the bid date and negative returns at the termination date. This is evidence in favour of the synergy hypothesis, that a termination signals the loss of real productive gains. When looking more closely at terminated offers, they find that permanent revaluations are maintained by the subset of unsuccessful firms that receive follow-up offers. These revaluations are again consistent with the predictions of the synergy hypothesis (or efficiency explanation). The existence of efficiency in assets sales is measured by gains in sell-offs or the seller's announcement returns. Alexander, Benson, and Kampmeyer (1984), Hite, Owers, and Rogers (1987), and John and Ofek (1995) find evidence supporting that the announcement return is higher when the division is sold to a buyer who might have a comparative advantage in managing the divested division.

Maksimovic and Phillips (2001) report that transactions of asset sales increase economic efficiency, a result that is consistent with the positive valuation effects for asset sales reported by Jain (1985), Klein (1986), and Hite, Owers, and Rogers (1987). Maksimovic and Phillips (2001) also support the efficiency explanation for asset sales that firms grow and purchase assets efficiently across industries in which they operate. By examining the timing of sales and the pattern of efficiency gains, they find that the transactions of asset sales, especially through sales of plants and divisions, tend to improve the allocation of resources and are consistent with a simple neoclassical model of profit maximising by firms. In particular, Maksimovic and Phillips (2001) find that asset sales are more likely to occur when the assets are less productive than industry benchmarks and when the selling division is less productive. Their results show that most transactions in the market for assets result in productivity gains. Recently, Yang (2008) has developed a dynamic structural model in which a firm makes rational decisions to buy or sell assets in the presence of productivity shocks. He shows that asset sales decisions are driven by changes in productivity brought about by shocks: firms with rising productivity buy assets and firms with

falling productivity sell assets. Yang (2008) is also closely related to the work by Maksimovic and Phillips (2001, 2002).

Similarly, Warusawitharana (2008) presents and tests a model in which asset purchases and asset sales enable the transfer of capital from less productive to more productive firms. This theoretical development produces an endogenous selection model that links asset purchases and sales to the fundamentals of the firms. The key findings in Warusawitharana (2008) are that returns on assets and size strongly influence the choice of a firm as to whether it should purchase or sell existing assets, which is conditional on the decision to engage in a transaction. These findings indicate that corporate asset purchases and sales are consistent with efficient investment decisions.

### *C The Focusing Explanation*

The focusing explanation suggest that firms sell the unrelated asset to increase the focus and efficient operation of the core business. John and Ofek (1995) emphasise focus as an important motive for corporate divestitures; value gains come from better management of the assets remaining after divestiture. Empirically, they find that the seller's operations become more focused in the year of the divestiture,<sup>41</sup> and in 75% of the cases the divested division is unrelated to the seller's main operations. John and Ofek (1995) interpret these findings to be consistent with the *focus hypothesis*, which implies that eliminating negative synergies between the divested asset and the remaining assets should lead to better performance for the remaining assets after the divestiture. Kaplan and Weisbach (1992) also report that the reason most often cited for divestitures is to change corporate focus or strategy. Berger and Ofek (1999), by studying the precursors and outcomes of corporate refocusing, show that the valuation consequences of diversification strongly affect the probability of

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<sup>41</sup>There is an increase in the Herfindahl index and a decrease in the number of reported lines of business

divestiture. They find that, after controlling for other determinants of refocusing, firms with the greatest value losses due to diversification are most likely to be involved in divestitures.

#### **2.6.4 Long-term Performance and Method of Payment**

The long-term performance of divesting firms and methods of payment in asset sales are put together for two reasons. First, unlike M&A, both areas have been far less documented in asset sales literature. Second, of only two studies exploring the methods of payment in asset sales, both analysed the operating performance of buyers or sellers subsequent to asset sales.

##### ***A Long-term Stock Performance***

To the best of my knowledge, only Bates (2005) and Lee and Lin (2008) have investigated the long-run stock performance of divesting firms in asset sell-offs. Bates (2005) argues that the full impact of management's decision regarding the distribution of sale proceeds, or the reallocation of retained cash, is only partially incorporated into security prices around a sale announcement date. He finds positive abnormal returns up to two years subsequent to the announcement among investment sellers, and interprets this as evidence that the financial efficiency benefit prevails over the agency cost of managerial discretion.

Lee and Lin (2008), by using U.K. evidence, observe significantly negative abnormal return performances among sellers in the 12-60 months subsequent to the sell-off announcements, which is robust to various long-term stock performance measures. They also find a significantly positive association between long-term abnormal returns and the magnitude of cash proceeds for sellers reducing corporate debt, as well as for sellers in deeper financial distress or with higher growth prospects. This finding, as Lee and Lin (2008) claims, implies that asset sale activities indeed have

a significant impact on future shareholder wealth.

### ***B Method of Payment***

Slovin, Sushka, and Polonchek (2005) and Hege, Lovo, Slovin, and Sushka (2009) explicitly consider the differences between stock and cash payment in asset sales. Previous studies of asset sales document significant gains to sellers and very little gain to buyers, but there has been no treatment of the effects of the means of payment. Compared with the M&A literature, far less effort has been put into the issue of methods of payment in asset sales.

Slovin, Sushka, and Polonchek (2005) empirically analyse intercorporate asset sales where equity is the means of payment, and compare the results to cash asset sales. Their central finding is that the use of buyer equity to purchase operating assets generates significantly larger combined gains in wealth than cash asset sales, and that these gains are shared between buyers and sellers (10% for buyers and 3% for sellers). In contrast, in cash asset sales, all of the proportionately smaller gains of 1.9% go to the sellers. Combined wealth gains are larger for equity deals, but modest for cash deals. Overall, their results imply that buyer equity is an effective means of contracting in intercorporate asset sales, and the use of equity conveys favourable information about the value of assets and buyers.

Hege, Lovo, Slovin, and Sushka (2009) develop a two-sided asymmetric information model of asset sales. The central prediction of their model is that there are large gains in wealth for both buyers and sellers in equity-based asset sales, whereas cash sales generate significantly smaller gains that typically accrue only to sellers. This theoretical prediction is highly consistent with the empirical findings in Slovin, Sushka, and Polonchek (2005). Hege, Lovo, Slovin, and Sushka (2009) also proceed empirical tests and find consistent results with the predictions of their theoretical model.

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## Chapter 3

# Liquidity Measures and Empirical Methodology

### 3.1 Introduction

The purpose of this chapter is to generally discuss the measures of aggregate liquidity and related empirical methodologies applied in this thesis. Since both are consistently used in the following chapters, it is better to have a concentrated and detailed discussion here.<sup>1</sup> Particularly, I intend to answer the following questions in this chapter: How are aggregate liquidity measures constructed? Why are aggregate liquidity measures estimated by such methods? Which empirical methodologies are applied in this thesis?

Having proper measures of aggregate liquidity is crucial for this research, because they are key factors in examining the influences of liquidity on corporate events. The central aggregate liquidity measures consist of the aggregate corporate liquidity demand (ACLD) and the aggregate market liquidity supply (AMLS). I follow Greenwood (2005) to construct a measure of ACLD and follow Bohn (1998) and

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<sup>1</sup>In the following chapters, both aggregate liquidity measures and empirical methodologies will only be described briefly.

Krishnamurthy and Vissing-Jorgensen (2008) to construct a measure of AMLS. Besides introducing the construction methods, I also provide reasons for choosing these measurements. Both measures are selected because they can better represent the variation of liquidity demand and liquidity supply at aggregate level.

The major empirical methodology applied in the thesis belongs to the vast category of event study methods. Each research question, since aggregate liquidity is estimated with particular corporate events, requires measuring the stock returns and firm characteristics of event firms.<sup>2</sup> Using financial data, an event study can measure the (unanticipated) impact of a particular corporate event on the value of firms and the wealth of shareholders. I summarise both short-term and long-term event study methods in this chapter. Some of the descriptions are borrowed heavily from the contributions of published papers.<sup>3</sup> Please note that this chapter intends to provide a summary of empirical methodologies used in the thesis. The exact empirical methods applied for each research question should be based on the brief discussion in each chapter.

The remainder of this chapter is organised as follows. Section 3.2 introduces the construction methods and reasons for employing both aggregate liquidity measures. Section 3.3 summarises short-term methods, while Section 3.4 discusses long-term methods.

## 3.2 Aggregate Liquidity Measures

This section introduces the construction of aggregate liquidity measures. Section 3.2.1 shows the measure of aggregate corporate liquidity demand (ACLD) and Sec-

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<sup>2</sup>I discuss event studies that focus mainly on measuring stock price effects. Other types of event studies in the literature include examining trading volume (e.g. Campbell and Wasley (1996)), operating (accounting) performance (e.g. Barber and Lyon (1996)) and earnings management via discretionary accruals (e.g. Kothari, Leone, and Wasley (2005)).

<sup>3</sup>For studies on short-term methods, see Brown and Warner (1980, 1985) and Mackinlay (1997). For studies on long-term methods, see Barber and Lyon (1997), Kothari and Shanken (1997), Fama (1998), Lyon, Barber, and Tsai (1999), and Mitchell and Stafford (2000).

tion 3.2.2 shows the measure of aggregate market liquidity supply (AMLS). For both measures, the construction methods and reasons for applying such measures are described. Section 3.2.3 shows the empirical framework for applying aggregate liquidity measures.

### 3.2.1 Aggregate Corporate Liquidity Demand (ACLD)

#### A How to Construct?

The measurement of aggregate corporate liquidity demand (ACLD) should reflect the preference for liquid assets by corporate sector at aggregate level. In order to satisfy this setting, I follow the method in Greenwood (2005) to construct aggregate corporate liquidity. The ACLD is measured as the ratio of total corporate investment in liquid assets to the total sources of funds available. At aggregate level, corporate investments and fund raising activities should follow the following identity:

$$\underbrace{Profits - Dividends}_{\text{Internal Funds}} + \underbrace{Equity + Debt}_{\text{External Funds}} = \underbrace{\Delta L + \Delta F + \Delta I + \Delta W + \Delta Other}_{\text{Uses of Funds}} \quad (3.1)$$

where

*Profits* (*P*) = corporate book profits plus depreciation

*Dividends* (*Div*) = net dividend payments

*Equity* (*E*), *Debt* (*D*) = equity or debt issues

$\Delta L$  = changes in liquid assets

$\Delta F$  = changes in fixed assets

$\Delta I$  = changes in inventory

$\Delta W$  = changes in working capital

$\Delta Other$  = residual term.

The fixed capital ( $\Delta F$ ) includes land, plant or equipment. The residual term ( $\Delta Other$ ) includes inventory valuation adjustments, changes in miscellaneous liabilities, and a



calculation discrepancy. The identity shows that after collecting profits, paying taxes and dividends, and raising external financing in equity and debt, corporations must choose to allocate funds between a variety of possible investment activities. They may invest in working capital or fixed capital, or simply reserve these funds in liquidity.<sup>4</sup>

In equation (3.1), corporate profits minus dividends plus adjustments for foreign earnings retained abroad represent *internal funds*.<sup>5</sup> *External funds* are defined as funds raised through equity and debt offerings. Thus, total *sources of funds*, which equal the internal funds from production plus external funds from equity and debt issues, are given by the terms on the left-hand side of equation (3.1). The right-hand side of the equation shows the total *use of funds* available. The underlying logic is that, at the aggregate level of the corporate business sector, total sources of funds must equal total use of funds, which is also the principle underlying *Flow of Funds* accounts. All funds supplied by the corporate sector become the funds allocated.

Annual data on each of these variables and sub-items are collected from Table L102 and F102 in the U.S. Federal Reserve Board's *Flow of Funds* accounts for the period from 1970 to 2006. The *flow of funds* accounts record the acquisition of tangible and financial assets throughout the U.S. economy and document the sources of funds used to acquire those assets. The Federal Reserve gathers capital market flow data from a variety of internal and commercial sources. The *flow of funds* data begins in 1945 and is updated annually. The strengths of the *flow of funds* data are its consistent definitions, its availability over a long period of time and its comprehensive coverage. A complete description of the *flow of funds* is available from the Board of Governors of the Federal Reserve System, *Guide to the Flow of Funds Accounts*. Tables L102 and F102 show the levels and flows (changes) of financial assets and

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<sup>4</sup>Note that this relationship does not hold at the firm level, where mergers and acquisitions involving exchanges of equity complicate the decomposition.

<sup>5</sup>Corporate profits are calculated as (book) corporate profits before tax, plus the consumption of fixed capital, minus profit tax accruals.

liabilities of the non-farm and non-financial corporate business sectors in the U.S. through time, respectively.<sup>6</sup> The financial sector is excluded because its business involves inventories of marketable securities that are included in liquid assets.

Table 3.1 shows the summary statistics of variables collected from *Flow of Funds* accounts, which are used to construct ACLD. Since the uses of funds are equal to the sources of funds, all variables scaled by sources of funds ( $S$ ) are to be shown as percentages. Total sources of funds ( $S$ ) is the sum of the profits after paying out dividends ( $P - Div$ ), net equity issues ( $E$ ), and net debt issues ( $D$ ). As indicated in Table 3.1, on average, internal funds finance over 80% of corporate investment, and external funds only finance about 20%. These ratios vary dramatically over the time period of 1970 to 2006. Internal funds ( $(P - Div)/S$ ) reached the lowest (53.81%) in 1973 and the peak (115.65%) in 2006. For external funds, while debt offerings finance more than 27% of corporate investments, the share of net equity issues is negative on average and even reaches  $-5.22\%$  of total investment in a typical year. This surprisingly low ratio of equity issues occurs because the *Flow of Funds* appropriately nets out equity issues with equity repurchases and retirements.

In order to measure aggregate corporate liquidity demand, it is crucial to have a proper definition of *corporate liquid assets*. An ideal definition should include all assets which can be easily converted into cash with no, or low, transaction costs. As indicated in Greenwood (2005), an overly narrow definition of liquidity risks the possibility of results driven by certain classes of liquid assets, rather than by aggregating corporate investment in liquidity. On the other hand, an overly broad definition of liquidity risks including investment items that are held for purposes other than maintaining liquidity. Most of the items available in the *Flow of Funds*, which are related to the category of liquid assets, are included, except for foreign deposits. Similar to Greenwood (2005), I exclude foreign deposits because they are linked to liquidity needs outside the U.S. by offshore subsidiaries. Greenwood (2005) also

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<sup>6</sup>In Tables L102 and F102, flows are equal to the changes in the level for balance sheet variables.

**Table 3.1: Summary Statistics of Variables in Sources and Uses of Funds**

This table presents the summary statistics of variables in sources and uses of funds. Panel A shows the sources of corporate funds, including profits net of dividends ( $P - Div$ ), equity issues ( $E$ ), debt issues ( $D$ ). The sources of funds ( $S$ ) is the sum of these three variables. Panel B shows the uses of corporate funds, including changes in liquid asset ( $\Delta L$ ), changes in fixed assets investment ( $\Delta F$ ), changes in inventory investment ( $\Delta I$ ), changes in working capital ( $\Delta W$ ), and a residual term ( $\Delta Other$ ). All variables are scaled by total sources of corporate funds ( $S$ ). Data is collected from the U.S. Federal Reserve Board's *Flow of Funds* accounts for the period of 1970 to 2006. All variables are given in percentage except for number and autocorrelation.

	Number	Mean	Minimum	First Quartile	Median	Third Quartile	Maximum	Standard Deviation	Auto-Correlation
<b>Panel A: Sources of Funds</b>									
$(P - Div)/S$	37	80.32	53.81	71.59	77.98	88.44	115.65	14.38	0.67
$(E + D)/S$	37	19.68	-15.65	11.56	22.02	28.41	46.19	14.38	0.67
$E/S$	37	-7.77	-63.85	-14.85	-5.22	4.12	9.75	15.02	0.59
$D/S$	37	27.45	-13.26	21.82	29.52	36.84	48.20	13.55	0.49
<b>Panel B: Uses of Funds</b>									
$\Delta L/S$	37	5.16	-2.80	3.09	5.09	6.80	18.63	3.97	-0.05
$\Delta F/S$	37	80.17	58.99	70.98	80.16	85.35	103.62	10.68	0.60
$\Delta I/S$	37	4.22	-5.87	2.05	5.01	6.87	11.75	3.87	-0.06
$\Delta W/S$	37	3.58	-2.75	-0.56	2.46	5.44	27.19	5.96	0.61
$\Delta Other/S$	37	6.87	-24.19	0.53	7.85	16.66	24.69	11.55	0.34

excludes U.S. Treasuries in his sample because they introduce severe outliers between 1945 and 1950, when U.S. business received tax refunds in the form of wartime bonds. However, I include U.S. Treasury securities as they are liquid financial assets heavily held by U.S. corporations. More importantly, since the application of the ACLD measure in my research begins at 1970, the distortions of U.S. Treasury securities in 1945 and 1946 have no effects on my sample.

Under these reasons, I settle on the definition of liquidity ( $L$ ) as the following items:

$$\text{Liquidity components} \left\{ \begin{array}{l} \text{checkable deposits and currency} \\ \text{time and savings deposits} \\ \text{money market mutual fund shares} \\ \text{short-term security repurchase agreements} \\ \text{commercial paper} \\ \text{U.S. Treasury securities} \end{array} \right.$$

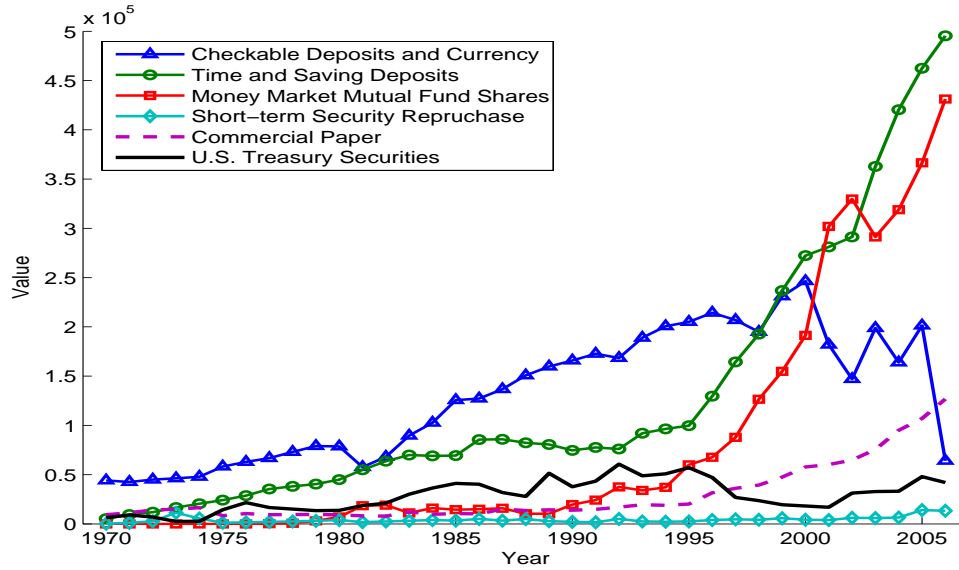
These common liquid assets are used by U.S. corporations for the purpose of liquidity reservation. Figure 3.1 shows the time series performance of levels and shares of corporate liquidity components holding from 1970 to 2006. The corporate sector increases liquid asset holding through time at the aggregate level. The figure reveals the increasing importance of money market mutual fund shares and time and saving deposits. These results correspond with the fact that many corporations now hold more professionally managed money market shares. Panel B of Figure 3.1 reflects the performance of these liquidity components by a percentage of total liquid assets, which shows the declining shares of U.S. Treasury securities and checkable deposits and currency. The holding ratios of security repurchase and commercial paper are relatively stable through time.

The aggregate corporate liquidity demand is defined as the liquidity investment

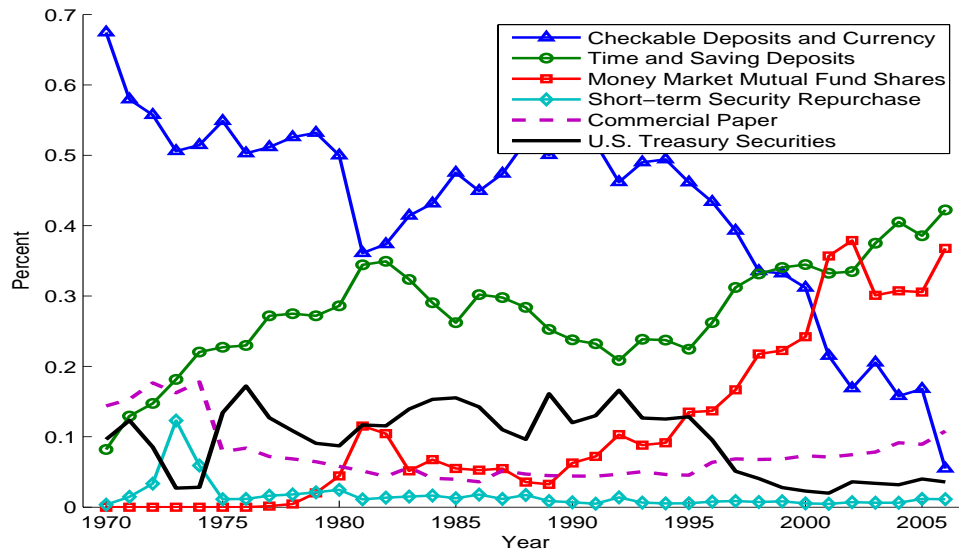
**Figure 3.1: Time-Series of Liquidity Components**

This figure presents the time-series performance of corporate liquidity components' holding levels (in Panel A) and holding ratios (in Panel B). The liquidity components include checkable deposits and currency, time and savings deposits, money market mutual fund shares, short-term security repurchase agreements, commercial paper, and U.S. Treasury securities. Panel A shows the level of these liquidity components. Panel B shows the ratios of liquidity components to total liquidity level. Data is collected from the U.S. Federal Reserve Board's *Flow of Funds* accounts for the period of 1970 to 2006.

**Panel A: Level of Liquidity Components**



**Panel B: Ratio of Liquidity Components**



share ( $\Delta L/S$ ), which is measured as the change in the level of aggregate liquidity holdings ( $\Delta L$ ) by corporate sector in aggregate divided by the total sources of funds ( $S$ ). Panel B of Table 3.1 shows the descriptive statistic of the ACLD measure ( $\Delta L/S$ ). For the period 1970–2006, the liquidity investment share has an average of 5.16% and a median of 5.09%; both the autocorrelation ( $-0.05$ ) and standard deviation (3.97) are small for  $\Delta L/S$ . Throughout the entire sample period, the ACLD ( $\Delta L/S$ ) is mostly positive, and only falls below zero during 1990 and 2006.<sup>7</sup> In Chapter 4, I also employ  $\Delta L/L_{t-1}$  as the measure of ACLD to explore its correlations with acquisition activity and performance. Although these have not been tabulated, the results from  $\Delta L/L_{t-1}$  are very similar to those generated by  $\Delta L/S$ . Thus, in this thesis, the measure of ACLD is defined as the liquidity investment share ( $\Delta L/S$ ).

**Table 3.2: Time-Series Regression Analysis**

This table presents the time-series regressions of aggregate corporate liquidity demand (ACLD) on the share of other items in the sources and uses of funds. The dependent variable in all regressions is the ACLD ( $\Delta L/S$ ), defined as the change in the level of aggregate liquidity holdings ( $\Delta L$ ) in aggregate divided by total sources of funds ( $S$ ). The independent variables include the share of sources raised by equity and debt issues ( $(E + D)/S$ ), the share of sources devoted to fixed asset investments ( $\Delta F/S$ ), the share of sources devoted to inventory investment ( $\Delta I/S$ ), and the share of sources devoted to working capital ( $\Delta W/S$ ). The sources of funds ( $S$ ) is the sum of profits net of dividends ( $P - Div$ ), equity issues ( $E$ ), and debt issues ( $D$ ). Data is collected from the U.S. Federal Reserve Board's *Flow of Funds* accounts for the period of 1970 to 2006.  $t$ -statistics are reported in parentheses.

Independent Variables	(1)	(2)	(3)	(4)
$(E + D)/S$	-0.048 (-1.04)			0.001 (0.01)
$\Delta F/S$		0.032 (0.47)	0.023 (0.35)	0.024 (0.21)
$\Delta I/S$		-0.151 (-0.82)	-0.105 (-0.56)	-0.105 (-0.54)
$\Delta W/S$			-0.141 (-1.22)	-0.142 (-1.02)
Constant	0.061 (5.47)	0.033 (0.57)	0.043 (0.74)	0.042 (0.38)

Before continuing, I examine some basic properties of the ACLD time series

<sup>7</sup>Another possible measure of ACLD is the percentage change in liquidity levels ( $\Delta L/L_{t-1}$ ), which is measured as the ratio of changes in the level of aggregate liquidity holdings ( $\Delta L$ ) to the level of aggregate liquidity holdings in the last year ( $L_{t-1}$ ). This liquidity measure ( $\Delta L/L_{t-1}$ ) shows a very high degree of correlation with the  $\Delta L/S$ , and is also suggested in Greenwood (2005) for robustness tests.

$(\Delta L/S)$ . In particular, I test whether changes in aggregate liquidity measures can be explained by changes in other items in sources or uses of investment funds. If, for example, equity issues and liquidity holdings were highly correlated, then one could question whether the relation between them drives the documented relationship between aggregate corporate liquidity demand and corporate events.<sup>8</sup> Although  $\Delta L/S$  is related to other investment shares based on identity between the sources and uses of funds in equation (3.1), it is important to check whether any one of these variables individually accounts for most of the variations in liquidity.

Table 3.2 shows the results of the time series regressions of ACLD ( $\Delta L/S$ ) on the share of other items in the sources and uses of funds including equity and debt issues  $(E + D)$ , changes in fixed asset investments  $(\Delta F)$ , changes in inventory investment  $(\Delta I)$ , and changes in working capital  $(\Delta W)$ . The results show that ACLD ( $\Delta L/S$ ) has extremely small correlations with the share of sources raised by equity and debt issues  $((E + D)/S)$  and the share of sources devoted for fixed asset investments  $(\Delta F/S)$ . In addition,  $\Delta L/S$  is negatively related to the share of sources devoted for inventory  $(\Delta I/S)$  and working capital  $(\Delta W/S)$ . None of these coefficients are statistically significant. Thus, the variation of ACLD ( $\Delta L/S$ ) cannot be explained by any other items found in the sources and uses of funds.

## ***B Why this Method?***

Why do I follow Greenwood (2005) and use data from the U.S. Federal Reserve Board's *Flow of Funds* accounts to construct liquidity investment share ( $\Delta L/S$ ) as the measure of aggregate corporate liquidity demand? This question can be answered from three perspectives. First, in academic literature, the *Flow of Funds* accounts are widely used to form aggregate time series data. For example, Baker and Wurgler (2000) examine whether the share of equity issues in the total of new equity and debt

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<sup>8</sup>Greenwood (2005) applies such a regression analysis to examine whether liquidity holdings can be explained by other potential determinants. Here, I apply such a method to examine the validity of the aggregate liquidity measure.

issues is a strong predictor of U.S. stock market returns between 1928 and 1997. This is, in certain aspects, similar to Greenwood (2005), which investigates the predictive power of aggregate investment in liquidity as a share of total corporate investment to subsequent U.S. stock market returns. Both papers require a proper measure of time series data at the aggregate level. Although Baker and Wurgler (2000) use the gross new equity and debt issues data reported by the *Federal Reserve Bulletin* to compute the equity share, they also examine the equity share series constructed by using *Flow of Funds* data, which yields similar coefficient results and similar predictive power. Moreover, the significant advantage of the *Flow of Funds* series is that they net out equity repurchases and debt retirements and provide net changes in equity and debt for the economy as a whole. This property of *Flow of Funds* data better fits my research in aggregate liquidity, because the data series can reflect the actual funds available for the corporate sector in aggregate.

Baker, Greenwood, and Wurgler (2003), by using an aggregate time series data on share of long-term debt issues to total debt issues, investigate how the maturity of corporate debt issues is related to market conditions and predictable variation in excess bond returns. The aggregate data is constructed from the Federal Reserve *Flow of Funds*. Some previous studies, such as White (1974) and Taggart (1977), already apply *Flow of Funds* data to explore aggregate debt issues. As stated in Baker, Greenwood, and Wurgler (2003), the strengths of the *Flow of Funds* data are its consistent definitions, its comprehensive coverage, and its availability over a long time span.

Second, compared with aggregated firm-level data from Compustat, there are some advantages of using aggregate data from *Flow of Funds*. Notably, Opler, Pinkowika, Stulz, and Williamson (1999) measure liquid asset holdings at firm-level as the ratio of cash and marketable securities to total assets and marketable securities. The firm-level cash-to-assets and cash-to-sales ratios are commonly used to



explore the determinants or value of corporate liquidity holdings.<sup>9</sup> However, Compustat measures cannot capture the liquidity holdings by new firms, or cash reduction coincidental with firm de-listing. In addition, the *Flow of Funds* data certainly includes more firms than Compustat, which should better reflect the U.S. corporate sector at aggregate level. Greenwood (2005) also constructs an alternative series of aggregate liquidity using firm-level data from Compustat, where the basic results using Compustat data line up with the *Flow of Funds* results.

Third, the variation of aggregate liquidity investment share ( $\Delta L/S$ ) cannot be explained by other theories of corporate liquidity holdings, which should reflect a higher portion of motivation by corporate sector to hoard liquid assets in the event of liquidity shortages. Many studies in corporate finance link optimal liquid asset holdings with time-varying investment opportunities. It is necessary, therefore, to examine whether the measure of ACLD is driven by any other theories. Opler, Pinkowika, Stulz, and Williamson (1999) explicitly examine whether optimal corporate liquidity holdings can be explained by transaction costs models, agency-based models, and information models. Greenwood (2005) follows Opler, Pinkowika, Stulz, and Williamson (1999), and finds that changes in the costs or benefits of cash holdings, which are related to the transactions theory, agency theory, or asymmetric information theory of liquid asset holdings, have no explanatory power for the time series of liquidity investment share ( $\Delta L/S$ ). Thus, the liquidity investment share ( $\Delta L/S$ ) should be a proper measure of aggregate corporate liquidity demand.

### 3.2.2 Aggregate Market Liquidity Supply (AMLS)

#### *A How to Construct?*

The aggregate market liquidity supply (AMLS) is measured as the U.S. *Debt/GDP* ratio. The debt-to-GDP ratio is measured as Public Debt at the end of the govern-

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<sup>9</sup>See, for example, Dittmar, Mahrt-Smith, and Servaes (2003) and Harford, Mansi, and Maxwell (2008).

ment's fiscal year, which corresponds to the end of the third quarter of each year, divided by the GDP of the same fiscal year. The *Debt/GDP* series is downloaded from Henning Bohn's website, which provides *Debt/GDP* series for 1971 to 2003.<sup>10</sup> I update the *Debt/GDP* series until 2006 with data from the Economic Report of the President. Bohn constructs the *Debt/GDP* as the ratio of publicly held Treasury debt in the U.S. related to GDP.<sup>11</sup> Public Debt is different from the Gross Federal Debt, which also includes intra-governmental obligations to social security and other trust funds. Thus, this measure of debt includes debt held by the Federal Reserve, which should better represent AMLS in the U.S. for the corporate sector as a whole.

The time series of *Debt/GDP* ratio is applied widely in both finance and economic research. For instance, Bohn (1998) and Krishnamurthy and Vissing-Jorgensen (2008) both use *Debt/GDP* in their studies. In the field of fiscal policy, Bohn (1998) explores whether the U.S. government responds properly to changes in the debt-to-GDP ratio. He finds that the U.S. government does take corrective actions against raising public debt by reducing non-interest outlays, which counteract the changes in debt. Krishnamurthy and Vissing-Jorgensen (2008) show that the U.S. *Debt/GDP* ratio is negatively correlated with the spread between corporate bond yields and Treasury bond yield; they use the *Debt/GDP* ratio as the measure of aggregate supply of Treasury securities. The negative correlation suggests that corporate bond spread is high when debt supply is low, while the spread is low when the debt supply is high. Since public debt and Treasury securities are extremely liquid assets in the market, both studies show implicitly the importance of the *Debt/GDP* ratio in measuring the aggregate market supply of liquidity.

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<sup>10</sup>Time series data is available on Henning Bohn's website (<http://www.econ.ucsb.edu/~bohn/>).

<sup>11</sup>Data for publicly held Treasury debt is from the WEFA database, Federal Reserve Banking and Monetary Statistics and recent issues of the Economic Report of the President.

## ***B Why this Method?***

Why is the ratio of U.S. *Debt/GDP* a proper measure for aggregate market liquidity supply? First, the *Debt/GDP* reflects the supply of government debt and Treasury securities, which are typical liquid assets in the financial markets. The liquidity property of Treasuries is important for their holders, as they can easily liquid assets in the market. The liquidity motive is analogous to the demand for holding money, which also offers a low rate of return and yet is still held in equilibrium. This is because, as suggested by money demand theories, of the special liquidity services from holding money.

Second, some academic research has already found that Treasury debt carries a liquidity premium. Longstaff (2004) finds a large liquidity premium in Treasury bonds, which means that some market investors prefer to hold highly liquid securities such as U.S. Treasury bonds rather than less liquid securities. Longstaff (2004) also shows a potential correlation between the supply of Treasury bonds to the liquidity premium. Both findings are consistent with the theoretical predictions in Holmström and Tirole (1996, 1998). The links between AMLS and liquidity premium are suggested in Holmström and Tirole (2001), where there is a negative correlation between AMLS and the liquidity premium or asset prices. Based on these two reasons, the U.S. *Debt/GDP* ratio certainly is a proper measure of market liquidity supply at aggregate level, because it captures the supply of typical liquid assets in the U.S. market by government and has a closer connection with the liquidity premium.

### **3.2.3 Empirical Framework**

One of the major purposes of this thesis is to investigate the importance of aggregate liquidity by linking corporate decisions on investment and finance with the factors of aggregate liquidity. In contrast to previous studies that identify periods of corporate events based on macroeconomic criteria (see Choe, Masulis, and Nanda (1993)),

the volume of events (see Bayless and Chaplinsky (1996) and Helwege and Liang (2004)), or market valuation (see Bouwman, Fuller, and Nain (2009)), I use aggregate liquidity to identify the periods when conditions are most favourable or unfavourable for various corporate activities.<sup>12</sup>

In this research, the sample period of a particular corporate event is partitioned into high-, medium-, and low-liquidity periods based on the aggregate liquidity data in the year prior to the announcement date of corporate events. For instance, the M&A market in year  $t$  is defined as high-liquidity (30%), medium-liquidity (40%), and low-liquidity (30%) markets based on the level of aggregate liquidity in the year  $t - 1$ . Following this, the performances of event firms in different liquidity markets are measured and compared. By using aggregate liquidity factors, the goal is to determine whether there are fundamental differences in the performances of event firms between high- and low-liquidity corporate investment and financing events.

In general, the sample of corporate events is classified into different groups based on the market condition of certain factor. This method has been widely used in previous studies.<sup>13</sup> Different from these studies, I define period of market condition according to the aggregate liquidity data in the year before. There are two reasons for using the prior year's liquidity data. First, both measures of aggregate liquidity are *leading* macroeconomic indicators; they reflect the condition of liquidity demand and liquidity supply at aggregate level. As indicated in Bodie, Kane, and Marcus (2008), given the cyclical nature of the business cycle, leading economic indicators are those economic series that tend to rise or fall in advance of the rest of the economy, helping to predict the cycle of the business situation.<sup>14</sup> The stock market price index is a leading indicator, as stock prices are forward-looking predictors of future

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<sup>12</sup>This does not suggest that other factors are unimportant; it is only because they are not exclusive factors and the factors of aggregate liquidity could contribute to previous findings

<sup>13</sup>See, for example, Ritter (1984), Choe, Masulis, and Nanda (1993), Bayless and Chaplinsky (1996), Helwege and Liang (2004), Yung, Çolak, and Wang (2008), and Bouwman, Fuller, and Nain (2009).

<sup>14</sup>See p.576-582 and Table 17.2 in Bodie, Kane, and Marcus (2008) for discussions on economic indicators.

profitability. In Greenwood (2005), ACLD ( $\Delta L/S$ ) is found to be a strong predictor of stock market returns. Together, it is reasonable to consider aggregate liquidity demand as a leading indicator of the business cycle. Also shown in Bodie, Kane, and Marcus (2008), money supply is another leading indicator. Today's monetary policy might well affect and predict future economic activity; therefore, AMLS ( $Debt/GDP$ ) certainly is a leading indicator of the economy.

Secondly, the data for constructing aggregate liquidity are mostly accounting and economic data, reported with low frequency. Unlike financial market data, which can be observed fairly quickly, these data are usually updated quarterly or annually, with a certain delay. To make sure decisions for corporate events are made based on observable data, I use a one-year lag in applying factors of aggregate liquidity.

Finally, the results of the empirical analysis in the following chapters are not sensitive to the one-year lag in liquidity measures. For all three corporate events, instead of classifying the sample period with last year's aggregate liquidity, I also examine the influence of *coincident* liquidity on the activity and performance of corporate events. The results indicate similar patterns and correlations between aggregate liquidity and corporate events. In this research, the major results are robust enough to apply either the prior or current year's aggregate liquidity.

### 3.2.4 Summary

Table 3.3 shows the annual values of ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ). Compared to AMLS, the ACLD has larger variations through the whole time period. The  $\Delta L/S$  has a positive value in most of the years, and only falls below zero in 1990 and 2006, which means that the entire corporate sector only reduced the reservation of liquid assets in these two years. The  $Debt/GDP$ , which has a mean value of 36%, reached its peak in 1993 and 1994.

It is important to understand that ACLD and AMLS are independent measures of

**Table 3.3: Annual Value of Aggregate Liquidity Measures**

This table presents the annual values of aggregate liquidity measures between 1970 to 2006. Aggregate corporate liquidity demand is defined as the liquidity investment share ( $\Delta L/S$ ), which is measured as the change in the level of aggregate liquidity holdings ( $\Delta L$ ) divided by the total sources of funds ( $S$ ). The sources of funds ( $S$ ) is the sum of profits net of dividends ( $P - Div$ ), equity issues ( $E$ ), and debt issues ( $D$ ). Aggregate market liquidity supply is defined as the U.S.  $Debt/GDP$  ratio, which is measured as public debt at the end of the government's fiscal year divided by GDP of the same fiscal year. Results are shown in percentage. Data of  $\Delta L/S$  is collected from the U.S. Federal Reserve Board's *Flow of Funds* accounts. Data of  $Debt/GDP$  is downloaded from Henning Bohn's website and updated until 2006 from the Economic Report of the President.

Year	$\Delta L/S$	$Debt/GDP$	Year	$\Delta L/S$	$Debt/GDP$
1970	1.74	28.00	1988	0.24	40.93
1971	6.98	27.99	1989	6.63	40.65
1972	5.09	27.26	1990	-1.13	42.13
1973	6.02	26.01	1991	5.13	45.21
1974	0.84	23.85	1992	6.07	47.98
1975	8.59	25.15	1993	3.83	49.39
1976	9.64	28.31	1994	3.23	49.27
1977	2.12	27.74	1995	5.02	49.26
1978	3.17	27.24	1996	6.25	48.42
1979	3.50	25.65	1997	3.51	46.10
1980	3.05	26.05	1998	6.32	43.09
1981	0.63	25.94	1999	11.53	39.75
1982	6.04	28.68	2000	10.06	35.23
1983	8.24	32.81	2001	6.04	33.03
1984	4.50	34.09	2002	3.13	34.05
1985	5.61	36.33	2003	11.02	35.99
1986	3.86	39.54	2004	7.59	37.30
1987	1.16	40.46	2005	18.63	37.40
			2006	-2.80	37.00

aggregate liquidity. They reflect liquidity demand by corporate sector and liquidity supply by market at the aggregate level, respectively. Inspired by previous studies on corporate liquidity, which investigate the motivations for liquidity holdings (see Opler, Pinkowika, Stulz, and Williamson (1999) and Kim, Mauer, and Sherman (1998)) and the potential effects of liquidity reserves (see Harford (1999) and Oler (2008)), I employ the factor of aggregate liquidity demand. Additionally, inspired by theoretical and empirical studies examining the effect of liquidity supply (see Holmström and Tirole (1998, 2001), Longstaff (2004), and Sundaresan and Wang (2009)), I also take the measure of aggregate liquidity supply into consideration.

Since both aggregate liquidity measures originate from different aspects, the performance of each factor is not necessarily similar. More importantly, the prediction of aggregate liquidity on corporate events can be different, because, in this research, AMLS ( $Debt/GDP$ ) is not considered a substitute for ACLD ( $\Delta L/S$ ). Both measures are applied and examined to explore the potential correlations between aggregate liquidity and corporate investment and financing events from different angles. My major intention is not to examine whether AMLS and ACLD produce the same predictions on corporate events, but simply to investigate whether and how aggregate liquidity influences the activity of corporate events and the performance of event firms.

### 3.3 Short-term Event Study Methods

#### 3.3.1 Definition and Structure

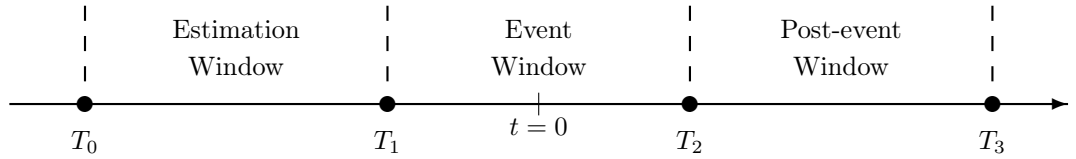
It is necessary to lay down some definitions and introduce the procedure for an event study. Some of the definitions in this section are borrowed from Mackinlay (1997).

## A Event Window

The *event window* is an event of interest and the period over which the security prices of the firms involved in this event will be examined. For instance, with an acquisition announcement, the event window will include the single day when the merger deal is announced. It is customary to define the event window as larger than the specific period of interest. In particular, the period of interest is often expanded to multiple days. It is possible to include days before and after the event into the period of interest, which may capture the price effects of the announcement around the event date. For example, if the announcement of events happens after the stock market closes on the recorded announcement day, which is quite often the case with seasoned equity offerings, the event window including the day of and the day after the announcement can capture the price effects. Furthermore, in the case of an acquisition announcement, if the merger information is leaked or expected, researchers can enlarge the pre-event period to investigate this possibility.

**Figure 3.2: Time Line for an Event Study**

This figure presents the timing sequence for an event study. Defining  $t = 0$  as the event date,  $(T_1, T_2)$  represents the event window.  $(T_0, T_1)$  is the estimation (pre-event) window.  $(T_2, T_3)$  is defined as the post-event window. Even if the event being considered is an announcement on a given date, it is typical to set the length of event window to be larger than one.



The estimation window is the period prior to the event window for estimating parameters. Generally, the event period itself is not included in the estimation period to prevent the event from influencing the normal estimation of parameters. Figure 3.2 illustrates the timing sequence of an event study. With the parameter estimated in the estimation window  $(T_0, T_1)$ , the abnormal returns can be calculated for event



window  $(T_1, T_2)$ . With the event study structure set, the remaining question is how to design the estimation framework for abnormal returns. The presentation of the empirical results follows the designation of the econometric methods. Ideally, the empirical results will lead to an understanding of the sources and causes of the effects of the event under study.

## ***B Measure of Abnormal Return***

The abnormal return is the actual *ex post* return of security over the event window minus the normal return of firm (or benchmark) over the event window. The normal return is defined as the expected return without conditioning on the event taking place. For security  $i$  and event date  $t$ , the abnormal return is measured as:

$$AR_{it} = R_{it} - E(R_{it}|X_t) \quad (3.2)$$

where

$AR_{it}$  = abnormal returns for period  $t$

$R_{it}$  = actual returns for period  $t$

$E(R_{it}|X_t)$  = normal (expected) returns for period  $t$

$X_t$  = conditioning information for the normal return model

There are two common choices for modelling the normal return: the *constant mean return model* ( $X_t$  is a constant) and the *market model* ( $X_t$  is the market return).<sup>15</sup> The constant mean return model assumes that the mean return of a given security is constant through time. Let  $\mu_i$  be the mean return for asset  $i$ . Then, the constant mean return model is:

$$R_{it} = \mu_i + \zeta_{it} \quad (3.3)$$

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<sup>15</sup>Here, I follow the definition and classification in Mackinlay (1997).

where  $R_{it}$  is the period  $t$  return on security  $i$  and  $\mu_{it}$  is the period  $t$  disturbance term for security  $i$  with an expectation of zero and variance  $\sigma_{\zeta_i}^2$ . Brown and Warner (1980, 1985) find that the constant mean return model often yields results similar to those of more sophisticated models.

However, in the literature, the constant mean return model is not widely used as the market model or the market-adjusted model. The market model assumes a stable linear relation between the market return and the security return, and relates the return of any given security to the return of the market portfolio (index). The advantage of the market model is that it removes the portion of return that is related to variation in the market return, which means the variance of the abnormal return is reduced. This will lead to an increased ability to detect the effects of an announcement in the market.

I will now briefly discuss these two short-horizon event study methods: *market model* and *market-adjusted model*. These two methods are the most commonly used short-term methodologies in corporate finance literature. The market-adjusted model can be used to avoid data availability problems.<sup>16</sup> For some events, it is not feasible to have a pre-event estimation period for the expected model parameters, such as initial public offerings (see, e.g., Ritter (1991)). Based on the findings in Brown and Warner (1980, 1985), there should be no significant differences between the results from these two models.<sup>17</sup>

### 3.3.2 Market Model

The *market model* is frequently used in empirical studies to measure the adjustment of security returns to new information, which represents the impact of event-specific

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<sup>16</sup>The market-adjusted model can be viewed as a restricted market model with  $\alpha$  constrained to zero and  $\beta$  constrained to one.

<sup>17</sup>There are some other models for short-run event studies such as multi-factor models and economic models. Because these models only increase very limited gains for event studies and have not been used in the thesis, they are not included in this section. Please refer to Mackinlay (1997) for a further discussion on event study models.

information. The model arises as an implication of the assumption that the joint distribution of returns on securities is multivariate normal. To investigate the announcement effect of events, the market model is constructed by the following steps. First, the rate of return on a security over a particular holding period (estimation window  $T_0$  to  $T_1$ ) is measured as:

$$\tilde{R}_{it} = \alpha_i + \beta_i \tilde{R}_{mt} + \tilde{\varepsilon}_{it} \quad (3.4)$$

where

- $\tilde{R}_{it}$  = rate of return on security  $i$  for period  $t$
- $\tilde{R}_{mt}$  = rate of return on market index for period  $t$
- $\alpha_i, \beta_i$  = regression coefficients vary from one security to another
- $\tilde{\varepsilon}_{it}$  = stochastic error term.

Model (3.4) is estimated on a set of data relative to the event date (estimation window), with event observation days surrounding the event date deleted. Note that the estimation date can be either before or after the event date depending on the research purpose, while the pre-event period is mostly used as an estimation window. Under general conditions, ordinary least squares (OLS) is a consistent estimation procedure for market model parameters. Thus, OLS is used to estimate  $\alpha_i$  and  $\beta_i$ . They are calculated by regressing daily returns of security  $i$  on the market index over the estimation window period. Given the estimated market model parameters  $\hat{\alpha}_i$  and  $\hat{\beta}_i$ , the abnormal return to the security of firm  $i$  for period  $t$  (event window  $T_1$  to  $T_2$ ) is calculated as:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad (3.5)$$

where

$AR_{it}$  = abnormal returns of security  $i$  for period  $t$

$R_{mt}$  = rate of return on market index for period  $t$

$\hat{\alpha}_i, \hat{\beta}_i$  = OLS estimated market model coefficients.

Any observations of an abnormal return must be aggregated over the event window and across observations of the event to examine the event announcement effects. Specifically, the aggregation is along two dimensions — through time and across securities.<sup>18</sup>

The *average abnormal return* (AAR) for a particular time  $t$  relative to the zero event date is calculated as the sum of the abnormal returns at point  $t$  in the event window divided by the number of securities in the sample. In particular, given the event time,  $t = T_1, \dots, T_2$ , and  $N$  firms, the average abnormal return for time  $t$  is:

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad (3.6)$$

The average abnormal returns can then be aggregated over the event window. The *cumulative average abnormal return* (CAR) is measured as the sum of the average abnormal returns over a specific time period (event window) relative to the event date:

$$CAR_{(T_1, T_2)} = \sum_{t=T_1}^{T_2} AAR_t \quad (3.7)$$

Equivalently, the CAR can also be formed by cumulating through time of each security over event window then aggregating through the securities in the sample. Define  $\widehat{CAR}_{i(T_1, T_2)}$  as the sample CAR from  $T_1$  to  $T_2$  for firm  $i$ . The CAR from  $T_1$  to  $T_2$  is the sum of the included abnormal returns in event window for security  $i$ ,

$$\widehat{CAR}_{i(T_1, T_2)} = \sum_{t=T_1}^{T_2} AR_{it} \quad (3.8)$$

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<sup>18</sup>It is assumed that the abnormal returns and cumulative abnormal returns will be independent across securities.

Then the  $CAR_{(T_1, T_2)}$  is the sum of  $\widehat{CAR}_{i(T_1, T_2)}$  for the event window divided by the number of securities in the sample,

$$CAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N \widehat{CAR}_{i(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N \sum_{t=T_1}^{T_2} AR_{it} \quad (3.9)$$

### 3.3.3 Market-Adjusted Model

For short-horizon event studies, I apply the *market-adjusted model* by following Brown and Warner (1985). There are three reasons for using the market-adjusted model instead of the market model. First, the use of models sometimes depends on the data availability. When the pre-event estimation period for market model parameters is not feasible, the market-adjusted model can still be used. Second, for some event announcement samples such as takeovers and seasoned equity offerings there are repeated event markers through time. Specifically, multiple events are carried out by the same firms within a relatively short period, say one year. This phenomenon is quite common for acquiring firms in corporate takeovers and offering firms in seasoned equity offerings. In these cases, there is a high probability of multiple announcements in the estimation period. Any abnormal returns caused by these announcements will bias the estimated parameters for the market model, which will make beta estimations less meaningful. Third, it has been shown in Brown and Warner (1980) that, for short-window event studies, weighting the market return by the firm's beta does not significantly improve estimation results.

The daily abnormal return for a firm is calculated by deducting the equally-weighted (or value-weighted) return of market index from the firm's security return:

$$AR_{it} = R_{it} - R_{mt} \quad (3.10)$$

where

$AR_{it}$  = abnormal returns of security  $i$  for period  $t$

$R_{it}$  = rate of return on security  $i$  for period  $t$

$R_{mt}$  = rate of return on market index for period  $t$

The definitions of AAR and CAR are analogous to those for market model abnormal returns. CAR can be calculated by (1) first aggregating  $AR_{it}$  across securities then cumulating through time, or (2) first cumulating  $AR_{it}$  through time then aggregating across securities.

### 3.3.4 Test Statistics

Given the excess abnormal returns based on the market model and market-adjusted model, the statistical significance of abnormal returns can be assessed. The null hypothesis to be tested is that the cross-sectional average abnormal return (AAR) in the event window is zero, and that the cumulative average abnormal returns (CAR) over the event window (or different periods) are zero.

Based on the discussion on aggregating abnormal returns, two methods can be employed to cumulate  $AR_{it}$  into  $CAR_{(T_1, T_2)}$ . Although it is quite obvious that the  $CAR_{(T_1, T_2)}$  generated from both methods are the same, the test statistic results are different. The test statistics for these two procedures depend on the second step of aggregating abnormal returns. When the CAR is calculated by first aggregating  $AR_{it}$  across securities then cumulating through time, the *time-series standard deviation test* is used. When the CAR is calculated by first cumulating  $AR_{it}$  through time then aggregating across securities, the *cross-sectional standard deviation test* is used.

#### ***A Time-Series Standard Deviation Test***

The test statistics for any event time  $t$  is the ratio of the AAR in the event time (or day)  $t$  to its estimated standard deviation, where the standard deviation is estimated from the time series of the portfolio's AAR over the estimation period (usually the

pre-event period). The time-series standard deviation test *uses a single variance estimate* for the entire portfolio. Therefore, the time-series standard deviation test does not take account of unequal return variances across securities. Additionally, it avoids the potential problem of the cross-sectional correlation of security returns.

The test statistics for any event time  $t$   $AAR_t$  is:

$$t_{AAR_t} = \frac{AAR_t}{\hat{\sigma}_{AAR}} \quad (3.11)$$

where

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad (3.12)$$

$\hat{\sigma}_{AAR}$  is the estimated variance of  $AAR_t$ .  $\overline{AAR}$  is the average  $AAR_t$  through estimation period.<sup>19</sup>  $N$  is the number of securities that are available in the sample.  $M$  is the estimation period of  $M = T_1 - T_0 + 1$ .  $T_0$  and  $T_1$  are the beginning and ending times of the estimation period, respectively.

The test statistics that assess the statistical significance of abnormal return performance over a multi-day period  $T = T_2 - T_1 + 1$  (cumulative average abnormal returns  $CAR_{(T_1, T_2)}$ ) is:

$$t_{CAR} = \frac{CAR_{(T_1, T_2)}}{\hat{\sigma}_{AAR} * T^{1/2}} \quad (3.13)$$

where

$$CAR_{(T_1, T_2)} = \sum_{t=T_1}^{T_2} AAR_t. \quad (3.14)$$

## ***B Cross-Sectional Standard Deviation Test***

In a cross-sectional standard deviation test, the portfolio test statistics for time  $t$  in event period is:

$$t_{AAR_t} = \frac{AAR_t}{\hat{\sigma}_{AAR_t}/\sqrt{N}} \quad (3.15)$$

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<sup>19</sup>  $\hat{\sigma}_{AAR}$  is shown as  $\hat{\sigma}_{AAR}^2 = \frac{\sum_{t=T_0}^{T_1} (AAR_t - \overline{AAR})^2}{M-2}$ .  $\overline{AAR}$  is shown as  $\overline{AAR} = \frac{1}{M} \sum_{t=E_1}^{E_2} AAR_t$ .

and the test statistics for  $CAR_{(T_1, T_2)}$  is

$$t_{CAR} = \frac{CAR_{(T_1, T_2)}}{\hat{\sigma}_{CAR_{(T_1, T_2)}} / \sqrt{N}} \quad (3.16)$$

where  $\hat{\sigma}_{AAR_t}^2$  and  $\hat{\sigma}_{CAR_{(T_1, T_2)}}^2$  are the estimated variance of  $t_{AAR_t}$  and  $CAR_{(T_1, T_2)}$ , respectively.<sup>20</sup>

### *C Summary*

To sum up, two procedures can be utilised to cumulate abnormal returns observations. Although it is quite obvious that  $CAR_{(T_1, T_2)}$  generated from both methods are the same, their test statistic methods are different. Table 3.4 summarises the calculation methods and test statistics for short-term CAR. It is noteworthy that, although I classify the market model and market-adjusted model into event studies for short-term analysis, they can also be applied to test long-horizon security performance. Previous studies such as Brown and Warner (1980) and Kothari and Warner (1997) use the market model and market-adjusted model on monthly security data for long-horizon event study analysis.

## 3.4 Long-term Performance Measures

There have been long debates about the proper estimations of long-horizon abnormal returns. The important components of measuring long-term abnormal stock price performance include an estimator of abnormal performance and a means for determining the distribution of returns. Beginning with Ritter (1991), the most popular method for measuring long-term abnormal performance is buy-and-hold abnormal returns (BHAR). Although many concerns have been raised, it is still widely used

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<sup>20</sup> $\hat{\sigma}^2$  is shown as  $\hat{\sigma}_{AAR_t}^2 = \frac{1}{N-1} \sum_{j=1}^N (AR_{jt} - \frac{1}{N} \sum_{i=1}^N A_{it})^2$ .  $\hat{\sigma}_{CAR_{(T_1, T_2)}}^2$  is shown as  $\hat{\sigma}_{CAR_{(T_1, T_2)}}^2 = \frac{1}{N-1} \sum_{j=1}^N (CAR_{j, (T_1, T_2)} - \frac{1}{N} \sum_{i=1}^N CAR_{i, (T_1, T_2)})^2$ .



**Table 3.4: Summary of Short-term CAR Methods**

This table presents summary of the calculation and test statistic methods for short-term cumulative abnormal returns (CAR). There are two methods to cumulative  $AR_{it}$  into  $CAR_{(T_1, T_2)}$ . When the cumulative average abnormal returns (CAR) is calculated by first aggregating  $AR_{it}$  across securities then cumulating through time, the *time-series standard deviation test* is used. When the CAR is calculated by first cumulating  $AR_{it}$  through time then aggregating across securities, the *cross-sectional standard deviation test* is used.

Type	Method Description	
	<b>Panel A: By Security by Time, Time-Series Standard Deviation Test</b>	
CAR	$\underbrace{\text{Aggregate across securities}}_{\Rightarrow}$	$\underbrace{\text{Cumulate through time}}$
	$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it}$	$CAR_{(T_1, T_2)} = \sum_{t=T_1}^{T_2} AAR_t$
Statistics	$t_{AAR_t} = \frac{AAR_t}{\hat{\sigma}_{AAR}}$	and $t_{CAR} = \frac{CAR_{(T_1, T_2)}}{\hat{\sigma}_{AAR} * T^{1/2}}$
	<b>Panel B: By Time by Security, Cross-Sectional Standard Deviation Test</b>	
CAR	$\underbrace{\text{Cumulate through time}}_{\Rightarrow}$	$\underbrace{\text{Aggregate across securities}}$
	$\widehat{CAR}_{i(T_1, T_2)} = \sum_{t=T_1}^{T_2} AR_{it}$	$CAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N \widehat{CAR}_{i(T_1, T_2)}$
Statistics	$t_{AAR_t} = \frac{AAR_t}{\hat{\sigma}_{AAR_t} / \sqrt{N}}$	and $t_{CAR} = \frac{CAR_{(T_1, T_2)}}{\hat{\sigma}_{CAR_{(T_1, T_2)}} / \sqrt{N}}$

in studies on financial economics and corporate finance. Another well-recognised methodology is calendar-time portfolio returns (CTPR), advocated by Fama (1998) and Mitchell and Stafford (2000). Note that, despite extensive literature, there are no obviously better models for measuring long-term abnormal performance. Both BHAR and CTPR have low power against economically interesting null hypotheses and some misspecification.

### 3.4.1 Buy-and-Hold Abnormal Returns

Buy-and-hold abnormal returns (BHAR), also known as the characteristic-based matching approach, have been widely used to measure long-term abnormal performance in corporate finance. Early studies by Ikenberry, Lakonishok, and Vermaelen (1995), Barber and Lyon (1997), and Lyon, Barber, and Tsai (1999) provide supporting evidence for BHAR. An appealing feature of using BHAR is that buy-and-hold returns better resemble investors' actual investment experience than the periodic rebalancing employed in other approaches. Barber and Lyon (1997) argue that BHAR is an appropriate estimator because it "precisely measures investor experience." BHAR is calculated as the long-term buy-and-hold return of a sample firm less the long-term buy-and-hold return of a reference portfolio:

$$BHAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N (BHR_{i, (T_1, T_2)} - BHR_{p_i, (T_1, T_2)}) \quad (3.17)$$

where

$$BHR_{i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{it}) - 1. \quad (3.18)$$

$$BHR_{p_i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{p_i t}) - 1. \quad (3.19)$$

$BHR_{i, (T_1, T_2)}$  is the buy-and-hold returns for firm  $i$  over period  $T_1$  to  $T_2$ .  $BHR_{p_i, (T_1, T_2)}$  is the buy-and-hold returns for firm  $i$ 's reference portfolio over period  $T_1$  to  $T_2$ .  $N$

is the number of firms in the sample.  $T_2 - T_1$  is the horizon in months over which abnormal returns are calculated. BHAR captures the value of investment in the average sample firm relative to an appropriate benchmark over the horizon of interest. For the sample of event firms, the mean BHAR is calculated as the equally-weighted or value-weighted average BHAR of the individual firms.

### ***A Reference Portfolios and Returns***

In the literature, different kinds of benchmark can be applied in BHAR, which can be classified into three types: (1) market index (e.g. S&P 500 index, Nasdaq composite, CRSP value-weighted index, CRSP equal-weighted index); (2) control firm (e.g. size control firm, industry control firm, size/industry control firm ); (3) reference portfolio (e.g. size portfolio, book-to-market portfolio, size and book-to-market portfolio). Table 3 in Barber and Lyon (1997) provides a summary of research analysing long-run abnormal stock returns following corporate events, as well as the benchmarks used in each of the studies. Among the summarised studies, only three papers use the control firm approach, namely Ritter (1991), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995). Even for more recent research, very few use the control firm approach for benchmark estimation. Meanwhile, as reviewed in their table, the majority of studies construct reference portfolios as benchmarks, which shows the importance of the reference portfolio approach in BHAR. Therefore, in the following, I will only discuss using the market index and reference portfolios as benchmarks.

When the market index is used as a benchmark, the buy-and-hold returns for firm  $i$ 's reference portfolio are calculated as:  $BHR_{p_i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{mt}) - 1$ , where  $R_{mt}$  is the rate of return for the market index in month  $t$ ,  $BHR_{p_i, (T_1, T_2)}$  is the buy-and-hold returns for firm  $i$ 's reference portfolio over period  $T_1$  to  $T_2$ . This is a very straightforward estimation approach. Market index variations over the same holding period are taken out; however, since all securities in the sample of event

firms are matched with the same benchmark, disregarding the characteristics of each firm, only for different periods, this approach certainly has some drawbacks.

The advantage of the reference portfolio approach is that different benchmarks are constructed according to the uniqueness of each firm. The underlying assumption is that the reference portfolio matched on a firm's characteristics (e.g. size and book-to-market) perfectly proxy for the expected (normal) return on a security. Abnormal returns estimated under this method can better reflect the effects of corporate events in the long-horizon. However, it does require the correct construction of benchmark portfolios. Barber and Lyon (1997) and Kothari and Warner (1997) document similar evidence and show that the common estimation procedures of reference portfolios can produce biased BHAR estimates. In particular, bias arises from new listings, rebalancing of benchmark portfolios, and the skewness of multi-year abnormal returns. Proposed corrections include carefully constructing benchmark portfolios to eliminate known bias and conducting inferences via a bootstrapping procedure. I will discuss some of these issues in the following subsection and explore how the above corrections can be achieved under different settings.

In the thesis, I mainly apply the size and book-to-market portfolio approach to construct reference portfolios for BHAR. Although there are several paths for constructing reference portfolios, the size and book-to-market portfolio approach is probably the most popular one in the literature. Reference portfolios are constructed by matching each firm in the corporate event sample to a portfolio of firms that belong to the same size and book-to-market quintile as the event firm. As argued by Lyon, Barber, and Tsai (1999), firms from non-random samples should be compared to the general population on the basis of characteristics that are the best at explaining the cross-section of returns.

Size and book-to-market portfolios are created in line with Fama and French (1993), as follows:

1. I calculate the firm *size* (market value of equity) in June of each year  $t$  for all firms. The market value of equity is calculated using the price and common shares outstanding at the end of June.
2. In June of each year  $t$ , I rank all NYSE firms on CRSP on the basis of firm size, and form size quintile portfolios based on these rankings.
3. AMEX and Nasdaq firms are placed into the appropriate NYSE size quintiles based on their June market value of equity.
4. Within each size quintile, firms are sorted into quintiles based on their *book-to-market ratios* in year  $t - 1$ .
5. The book-to-market ratio in year  $t - 1$  is calculated as the book value of equity for the fiscal year ending in calendar year  $t - 1$ , divided by the market equity at the end of December of year  $t - 1$ .
6. The book value of equity is stockholder's equity (item 216) minus preferred stock plus balance sheet deferred taxes and investment tax credit (item 35), if available, minus post-retirement benefit asset (item 330), if available. If stockholder's equity is missing, I use common equity (item 60) plus preferred stock par value (item 130). If these variables are missing, I use book assets (item 6) less liabilities (item 181). Preferred stock is preferred stock liquidating value (item 10), or preferred stock redemption value (item 56), or preferred stock par value (item 130) in that order of availability.<sup>21</sup>

Event firms are assigned to twenty-five portfolios formed on size and book-to-market, using size quintile and book-to-market quintile breakpoints (from Kenneth French's website). For firms that have undertaken events in the period from July of year  $t$  to June of year  $t + 1$ , I determine the size and book-to-market quintiles at the

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<sup>21</sup>These item codes are used in Compustat database to identify variables.

fiscal year-end of calendar year  $t - 1$ . Many of the following discussions on BHAR are borrowed from Lyon, Barber, and Tsai (1999) and Bouwman, Fuller, and Nain (2009) to analyse and compare different reference portfolio measures.

There are two ways to calculate the long-term returns for size and book-to-market reference portfolios. The first method calculates, in each month, the mean return for each portfolio, and then compounds over  $(T_2 - T_1)$  months:

$$BHR_{pi,(T_1,T_2)}^{reb} = \prod_{t=T_1}^{T_2} \left[ 1 + \frac{\sum_{j=1}^{N_t} R_{jt}}{N_t} \right] - 1 \quad (3.20)$$

where  $T_1$  is the beginning time,  $T_2$  is the ending time,  $T_2 - T_1$  is the period of investment (in months),  $R_{jt}$  is the return on security  $j$  in month  $t$ , and  $N_t$  is the number of securities in month  $t$ . This is a more “traditional” way.

As argued in Lyon, Barber, and Tsai (1999), although research in financial economics commonly uses long-horizon reference portfolio returns calculated in this manner, they do not accurately reflect the returns earned on a passive buy-and-hold strategy of investing equally in the securities that constitute the reference portfolio. First, this portfolio return assumes monthly rebalancing to maintain equal weights. This leads to an inflated long-horizon return on the reference portfolio, which can likely be attributed to bid-ask bounce and non-synchronous trading. This is referred to as the *rebalancing bias* in Lyon, Barber, and Tsai (1999). Second, this portfolio return includes newly listed firms subsequent to portfolio formation (time  $T_1$ ). Since it is likely that firms that go public make up a significant portion of newly listed firms, the result is a downwardly biased estimate of the long-horizon return from investing in a passive (i.e. not rebalanced) reference portfolio in time  $T_1$ . They refer to this as the *new listing bias*. In reference to the rebalanced nature of this return calculation, I denote the return calculated in this manner with the superscript “reb.”

The second method of calculating the long-horizon returns on a reference portfolio involves first compounding the returns on securities constituting the portfolio, and

then summing across securities:

$$BHR_{p_i, (T_1, T_2)}^{bh} = \sum_{j=1}^{N_{T_1}} \frac{\left[ \prod_{t=T_1}^{T_2} (1 + R_{jt}) \right] - 1}{N_{T_1}} \quad (3.21)$$

where  $N_{T_1}$  is the number of securities traded in month  $T_1$ , the beginning period for the return calculation. The return on this portfolio represents a passive, equally-weighted investment in all securities constituting the reference portfolio in time  $T_1$ . There is no investment in firms listed subsequent to period  $T_1$ , nor is there monthly portfolio rebalancing. Consequently, the reference portfolio return calculated this way is free from new-listing bias and rebalancing bias. Related to the buy-and-hold nature of this return calculation, I denote the return calculated in this manner with the superscript “bh.”

Although this method of creating reference portfolios eliminates new-listing bias and rebalancing bias, it introduces a different problem. An event firm is assigned to an appropriate size and book-to-market portfolio at the time of the event announcement and, subsequently, the abnormal returns of the sample firm are measured relative to this group of firms for the entire horizon of interest. Insofar as the size and book-to-market characteristics of firms change over time, this method introduces inaccuracies in size and book-to-market matching. Calculating portfolio returns in this way prevents sample firms from being reassigned to new portfolios if size and book-to-market characteristics change.

## ***B BHAR $t$ -Statistics***

To test the null hypothesis that the mean BHAR is equal to zero for a sample of  $N$  firms, the *conventional  $t$ -statistic* method is employed:

$$t = \frac{\overline{BHAR}_{(T_1, T_2)}}{\hat{\sigma}(BHAR_{(T_1, T_2)})/\sqrt{N}} \quad (3.22)$$

where  $\overline{BHAR}_{(T_1, T_2)}$  is the sample mean of  $BHAR_{(T_1, T_2)}$  and  $\hat{\sigma}(BHAR_{(T_1, T_2)})$  is the cross-sectional sample standard deviation of BHAR for the sample of  $N$  firms.

Barber and Lyon (1997) document that long-horizon BHAR are positively skewed and that this positive skewness leads to negatively biased  $t$ -statistics. Lyon, Barber, and Tsai (1999) argue that inference should not be based on the normality assumption. Abnormal returns calculated using the control firm approach or buy-and-hold reference portfolios eliminate the new listing and rebalancing biases. Barber and Lyon (1997) also document that the control firm approach eliminates the skewness bias. Instead, to eliminate the skewness bias when using buy-and-hold reference portfolios, one can use the skewness-adjusted test statistic and bootstrap the critical values in order to draw an inference. The skewness-adjusted  $t$ -statistic is measured as follows:

$$t = \sqrt{N} \left( S + \frac{1}{3} \hat{\gamma} S^2 + \frac{1}{6N} \hat{\gamma} \right) \quad (3.23)$$

where

$$S = \frac{\overline{BHAR}_{(T_1, T_2)}}{\hat{\sigma}(BHAR_{(T_1, T_2)})} \quad \text{and} \quad \hat{\gamma} = \frac{\sum_{i=1}^N (BHAR_{i, (T_1, T_2)} - \overline{BHAR}_{(T_1, T_2)})^3}{N \hat{\sigma}(BHAR_{(T_1, T_2)})^3} \quad (3.24)$$

Note that  $\hat{\gamma}$  is an estimate of the coefficient of skewness and  $\sqrt{N}S$  is the conventional  $t$ -statistic.

### 3.4.2 Calendar-Time Portfolio Regression

A widely-used approach for measuring long-term stock performance is to track the performance of an event portfolio in calendar time and estimate risk-adjusted abnormal performance. The calendar-time portfolio regression (CTPR) approach was first introduced to financial economics literature by Jaffe (1974) and Mandelker (1974), and has since been advocated by many studies. The distinguishing feature of CTPR is its calculation of calendar-time portfolio returns for firms experiencing an event,



and the calibration of abnormal performance in multi-factor regression. Notably, Fama (1998) strongly advocates a monthly CTPR approach for measuring long-term abnormal performance. Compared with BHAR, the CTPR approach is less susceptible to the bad model problem, and any cross-sectional correlations of the event firms will be automatically accounted for in the portfolio variance at each point in calendar time. Mitchell and Stafford (2000) demonstrate the existence of a cross-sectional correlation of event firm abnormal returns, and, therefore, suggest the calendar-time approach.

To implement the CTPR approach, a time series of portfolio returns is constructed for a sample of firms' experiences of a corporate event (e.g. takeovers, IPOs, or SEOs).<sup>22</sup> In each calendar month over the entire sample period, a portfolio is constructed comprising all firms experiencing the event with the previous  $T$  months. The number of firms included in a portfolio is unlikely to be constant through time. In general, the portfolios are rebalanced monthly to drop all firms that reach the end of their  $T$ -month period and add all firms that have just announced a transaction. Equally-weighted or value-weighted portfolio returns are calculated in each calendar month. The time series of the portfolio returns net of the risk-free return over the sample period is regressed on the three Fama and French (1993) factors,

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_pSMB_t + h_pHML_t + \epsilon_t \quad (3.25)$$

or the Fama and French (1993) three factors and Carhart (1997) momentum factor as follows:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_pSMB_t + h_pHML_t + u_pUMD_t + \epsilon_t \quad (3.26)$$

where  $R_{pt}$  is the equal- or value-weighted return for calendar month  $t$  for the portfolio of event firms that experienced the event within previous  $T$  months,  $R_{ft}$  is the risk-

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<sup>22</sup>The description here is based on Mitchell and Stafford (2000) and Kothari and Warner (2007).

free rate,  $R_{mt} - R_{ft}$  is the excess return on the market portfolio,  $SMB_t$  is the difference between the return on the portfolio of “small” and “big” stocks,  $HML_t$  is the difference between the return on the portfolio of “high” and “low” book-to-market stocks,  $UMP_t$  is the difference between the return on the portfolio of past one-year “winners” and “losers”<sup>23</sup>, and  $\beta_p$ ,  $s_p$ ,  $h_p$ , and  $u_p$ , are sensitivities (betas) of the event portfolio to the four factors.

Within this framework, the intercept  $\alpha_p$  measures the average monthly abnormal return on the portfolio of event firms, which is zero under the null hypothesis of no abnormal performance. A positive intercept indicates that after controlling for market, size, and book-to-market factors in returns, a sample of event firms has a performance better than expected. Since  $\alpha_p$  is the average monthly abnormal performance over the  $T$  month post-event period, it can be multiplied by the number of months (e.g. 12, 24, or 36) to reflect annualised abnormal performance.

Similar to BHAR, recent evidence on the implications of using the CTPR approach is mixed. Brav and Gompers (1997), Fama (1998), and Mitchell and Stafford (2000) favour the CTPR approach. As stated in Barber and Lyon (1997), for measuring long-term abnormal performance, the CTPR approach (three- or four-factor model) has the advantage of not requiring size or book-to-market data for event firms. Therefore, firms without available data on these firm characteristics can still be included in the long-horizon analysis. Secondly, some large firms or firms with low book-to-market ratios may in fact have common stock returns that more closely mimic those of small firms or firms with high book-to-market ratios. In other words, returns of non-event firms matched on size and book-to-market might not fully represent the expected stock returns. The factor regression approach allows for this possibility since the pattern of returns determines whether the returns on a firm’s common stock more closely mimic the returns of small firms and/or high book-to-market firms.

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<sup>23</sup> $UMP_t$  is the Carhart’s (1997) momentum factor.

However, the calendar-time portfolio approach has some disadvantages. Loughran and Ritter (2000) argue against using CTPR because it might be biased toward findings' results consistent with market efficiency. One typical thread of research in corporate finance is that corporate managers positively time corporate events to exploit mispricing or market opportunities. By forming a calendar-time portfolio, the CTPR approach under-weights managers' timing decisions and over-weights other observations. Therefore, Loughran and Ritter (2000) argue that empirical tests that weight firms equally should have more power than tests that weight each time period equally. Since the CTPR approach weights each period (month) equally, it has less power to detect abnormal performance if corporate events cluster in certain periods due to managers' timing.<sup>24</sup> Fama (1998) suggests weighting calendar months by the number of event observations in each calendar month to overcome this potential problem.

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<sup>24</sup>The waves of corporate events have been widely documented in literature.

## Chapter 4

# Liquidity-Based Merger Valuation and Performance

### 4.1 Introduction

A substantial amount of theoretical and empirical studies in mergers and acquisitions (M&A) have explored many phenomena (patterns) associated with corporate takeovers. As summarised in Bouwman, Fuller, and Nain (2009), in general, aggregate acquisition activity occurs in waves through time; the abnormal returns in announcement periods are significantly positive for target firms, but may be significantly positive or negative for bidder firms; and post-acquisition returns to acquiring shareholders are significantly negative.<sup>1</sup> Substantial efforts have been employed to explain these takeover phenomena; many studies explore potential factors from other fields in finance to explain these long-existing puzzles and have made significant achievements.<sup>2</sup>

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<sup>1</sup>Announcement day returns and post-acquisition returns are higher for cash-financed acquisitions and lower for stock-financed acquisitions. For merger waves, see Andrade, Mitchell, and Stafford (2001) and Harford (2005). For announcement day returns, see Asquith (1983) and Jensen and Ruback (1983). For post-acquisition long-term returns, see Franks, Harris, and Titman (1991), Agrawal, Jaffe, and Mandelker (1992), Loughran and Vijh (1997), and Rau and Vermaelen (1998).

<sup>2</sup>See Rau and Vermaelen (1998) for the acquirer's valuation effects. See Asquith, Bruner, and Mullins (1983) and Moeller, Schlingemann, and Stulz (2004) for the acquisition's size effects. See

In corporate finance, there is considerable evidence that firms hold substantial amount of liquid assets (e.g. Opler, Pinkowika, Stulz, and Williamson (1999) and Bates, Kahle, and Stulz (2009)). Theoretical research in Holmström and Tirole (1998, 2001) shows that firms have substantial desires for liquid assets which serve as cushions against any future liquidity shocks.<sup>3</sup> Given the universal need of hoarding liquidity, we observe however that aggregate liquidity show cyclical variations through time. This pattern of aggregate liquidity can not be easily overlooked as this macro factor do carries potentially important implications on corporate investment decisions. Moreover, some previous studies such as Harford (1999) and Oler (2008) suggest that the corporate liquidity holdings have strong influences on the acquisition decisions and the performance of acquiring firms.

Inspired by the importance of aggregate liquidity in financial markets (e.g. Greenwood (2005) and Harford (2005)) and by studies suggesting the importance of liquidity in corporate investment and financing activity (e.g. Harford (1999) and Oler (2008)), I investigate whether aggregate liquidity factors influence the activity and performance of acquisitions. In particular, I ask the following questions: Are acquisitions announced during high aggregate liquidity period fundamentally different from those initiated during low aggregate liquidity periods? Can the valuation and performance of acquiring firms be explained by aggregate liquidity factors? The purpose of this research is to examine a potential factor (aggregate liquidity) for a number of commonly recognised anomalies in M&A. Similar to some previous studies,<sup>4</sup> I suspect the “commonly” existence of market anomalies related with M&A is just a consequence of some acquisitions’ extreme performance. In the present research, aggregate liquidity factors are applied to distinguish acquisition participants, and the performance and activity of acquisitions initiated in various status of aggregate

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Rhodes-Kropf, Robinson, and Viswanathan (2005) and Bouwman, Fuller, and Nain (2009) for market valuation effects.

<sup>3</sup>In contrast to perfect market models, firms desire to hold cash is driven by the their inability to pledge all of the expected income from incremental investment to the investors.

<sup>4</sup>See, for example, Rau and Vermaelen (1998) and Bouwman, Fuller, and Nain (2009).

liquidity are measured and compared.

Using a sample of 4,162 mergers announced in the U.S. between January 1, 1980 and December 31, 2003, I examine whether there are fundamental differences in the activity and performance between mergers announced in high-liquidity markets and those announced in low-liquidity markets. The measures of aggregate liquidity include aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS). In order to construct ACLD, by following Greenwood (2005), I use data reported in the Federal Reserve *Flow of Funds* to form a measure of the aggregate corporate accumulation of liquid assets as a fraction of total corporate investment spending. For AMLS, I follow Krishnamurthy and Vissing-Jorgensen (2008) and use the U.S. *Debt/GDP* ratio. Based on factors of aggregate liquidity, the basic specification classifies the sample period of M&A into high-, medium-, and low-liquidity periods according to the prior year's aggregate liquidity (and I refer to acquisitions that are announced during those periods as high-, medium-, or low-liquidity acquisitions, respectively). Next, I compare the activity and performance of acquisitions initiated in high- and low-liquidity takeover markets.

To empirically examine the performance of acquiring firms, I use several stock performance measures. Specifically, I apply cumulative abnormal returns (CAR) to measure pre-announcement and announcement abnormal returns, and buy-and-hold abnormal returns (BHAR) and calendar-time portfolio regressions (CTPR) to measure long-horizon post-merger performance. The short-term stock performance (announcement CAR) and long-term stock performance (post-acquisition BHAR and CTPR) of acquiring firms that announce acquisitions under different market circumstances of liquidity are also compared. Both pre- and post-merger performance are measured to examine whether the market's initial reactions and post-event reactions to acquiring firms' stock are consistent. The major focus of this research is to examine differences between the activity and performance of high-liquidity acquisitions and low-liquidity acquisitions. Although these empirical methods for stock perfor-

mance all have certain insufficiencies, I would expect the probability of measurement biases systematically affecting the differences in performance between high- and low-liquidity subsamples to be relatively small.

The distribution of acquisitions through time reveals a positive correlation between aggregate liquidity and merger activity. I find that more acquisitions are announced in high aggregate liquidity (both demand and supply) markets, while low-liquidity periods have less acquisition announcements. For the whole sample, there are 1,856 (1,794) deals initiated in high-liquidity demand (supply) periods. However, only 695 (582) acquirers announce acquisitions when aggregate liquidity demand (supply) is low. In order to test the robustness of this correlation, I control for various deal characteristics, namely the target firms' public status (i.e. public, private, subsidiary), the method of payment (i.e. cash, stock, mixed), and transaction values (i.e. large (30%), medium (40%) or small (30%)). The correlation remains strong after controlling for these factors. Moreover, when the sample is partitioned by aggregate liquidity and method of payment, more (less) acquisitions with stock payment take place than with cash payment when aggregate liquidity is high (low). Stock-financed acquisitions show a stronger correlation with liquidity than cash-financed acquisitions.

The results of merger performance are as follows. First, both pre-announcement CARs are higher when acquiring firms announce in high-liquidity markets, and lower for those announcing in low-liquidity markets. For instance, high-liquidity demand (supply) acquisitions have pre-announcement returns of 4.28% (1.38%), while the abnormal returns for low-liquidity demand (supply) acquisitions are  $-0.67\%$  ( $-0.40\%$ ). The differences between the two are statistically significant. Second, while all acquiring firms have a smaller positive CAR during announcement dates (three-day CAR is 0.84%), high-liquidity acquisitions remain with larger abnormal returns than low-liquidity acquisitions. Third, and interestingly, although high-liquidity acquirers generate higher announcement returns for their shareholders in announcement

periods than low-liquidity acquirers, the results of post-merger performance stand in sharp contrast to these. Specifically, high-liquidity acquisitions substantially underperform against low-liquidity acquisitions in the three years periods following the completion of acquisitions, as measured by BHAR and CTPR. Acquiring firms undertaking acquisitions during low-liquidity periods even have long-run returns close to zero. The three-year BHAR difference between high- and low-liquidity demand (supply) acquisitions is  $-16.35\%$  ( $-13.35\%$ ), and is significant at 1% level. Thus, high-liquidity mergers destroy value for shareholders in the long run, while low-liquidity mergers do not. These patterns remain robust after controlling for various deal characteristics, and are further supported by the results taken from the multivariate regression analysis. Overall, the main findings in this research suggest that low-liquidity acquisitions are fundamentally different from low-liquidity acquisitions.

The remainder of this chapter is organised as follows. Section 4.2 explains the development of the hypotheses in this study and reviews some related literature. Section 4.3 provides descriptions for the sample of mergers and empirical methodology. Section 4.4 tests the merger activity and its correlation with aggregate liquidity. In Section 4.5, both the short- and long-run performances of acquisitions are examined. Section 4.6 concludes this chapter.

## **4.2 Related Literature and Hypotheses Development**

### **4.2.1 Liquidity and Merger Activity**

Theoretical and empirical research on mergers and acquisitions (M&A) reveals that merger activity comes in waves (see Brealey, Myers, and Allen (2008)). Mitchell and Mulherin (1996) investigate the industry-level patterns in takeover and restructuring activity from 1982 to 1989. They document clear evidence of the clustering of merger waves within industries, and argue that these inter-industry patterns are directly



related to various technological, economic, or regulatory shocks to those industries. Andrade, Mitchell, and Stafford (2001) review previous findings and show that there have been three major takeover activity waves since the early 1960s, and the merger activity in the 1990s seems to be even more dramatic and widespread.

Early studies provided many possible reasons for takeover waves. The debates about the cause of merger waves were advanced by research on stock market valuations, which seems to be the most successfully supported theory in the literature. Shleifer and Vishny (2003) argue that stock market valuations drive a substantial portion of merger activity, which subsequently cause the clustering of merger activity in waves. They suggest that takeover bidders would like to use their overvaluation stocks to purchase target firms, especially when the overall market valuation is high. In essence, overvaluation in the whole market or in certain industries would lead to merger activity clustering in time. Rhodes-Kropf and Viswanathan (2004) also suggest the correlation between market valuation and aggregate merger waves by modelling rational managerial behaviour and uncertainty about sources of misvaluation. At the peak of market valuation, the clustering of transactions with overvalued acquisitions creates a merger wave. Many follow-up empirical evidences supporting the theory of market valuation have been found. In favour of market valuation theories, suggested by Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004), Rhodes-Kropf, Robinson, and Viswanathan (2005) show that market misvaluation affects the level of aggregate merger activity, the decision to be an acquirer or target, and the method of transaction. Further empirical evidences consistent with the explanation of stock valuation are also shown in Ang and Cheng (2006) and Dong, Hirshleifer, Richardson, and Teoh (2006), who use accounting data to estimate fundamental market valuation.

Another explanation for merger waves is that industries responding to shocks reorganise through takeovers and thereby create a clustering of merger activity (see, e.g., Mulherin and Boone (2000), Jovanovic and Rousseau (2001, 2002), and Maksi-

movic and Phillips (2001)). These studies suggest the neoclassical theory of merger waves; however, previous research in both streams of research only provide evidence consistent with their theories, rather than considering both neoclassical and misvaluation theories, and then formally rejecting one. Having recognised this, Harford (2005) systematically examines whether a clustering of mergers at the aggregate level is due to a combination of industry shocks, or whether due to market timing (misvaluation). Consistent with the neoclassical explanation of merger waves, he finds that economic, regulatory, and technological shocks drive industry merger waves.

Motivated by recent studies on corporate liquidity and aggregate liquidity, this research suggests a role for aggregate liquidity in explaining aggregate merger activity. Firstly, at firm-level, Harford (1999) shows that firms that have built up large liquidity reserves are more active in the acquisition market, and their acquisitions are more likely to be value-decreasing. Therefore, when the whole market is sufficient with liquid assets, bidding firms have a strong preference for attempting acquisitions, which subsequently leads to a clustering of mergers in that period. Similarly, Shleifer and Vishny (1992) hypothesise that an increase in cash simultaneously increases fundamental value and relaxes financial constraints, which causes the clustering of mergers in booms. Secondly, at aggregate-level, Harford (2005) argues that merger waves require both an economic motivation for transactions and relatively low transaction costs to generate a large volume of transactions, which is measured by a macro-level liquidity factor. Only when sufficient capital liquidity exists to accommodate the reallocation of assets will an industry shock generate a merger wave. Eisfeldt and Rampini (2006) also show that the variation in capital liquidity has an influence on the degree of total capital reallocation. Thirdly, Holmström and Tirole (2001) and Greenwood (2005) show potential correlations between aggregate liquidity and market valuations. Greenwood (2005) finds that aggregate investment in liquid assets as a ratio of aggregate corporate available funds is significantly negatively related to subsequent U.S. stock market returns. Thus, in line with market valuation theories

in M&A, aggregate liquidity should also play an important role in explaining merger activity.

It is worth noting that Holmström and Tirole's (2001) liquidity-based asset pricing model, which shows that the factor of aggregate liquidity has an influence on market valuation, is based on a rational theory of moral hazard. The market valuation theory in M&A by Shleifer and Vishny (2003) is established on a behavioural explanation. In this research, instead of trying to theoretically integrate these two distinct theories, I simply utilise the predictions of these two theories to suggest a potential correlation between aggregate liquidity and acquisitions. Empirical hypotheses are formed based on the implication of liquidity theory (aggregate liquidity affects market valuation) and valuation theory (market valuation affects merger activity and performance).

In summary, high corporate liquidity reserves and market provision for liquidity provide sufficient liquid capital for asset reallocation and reduce financing constraints for investments, which enhances the probability of making acquisitions. So, when the aggregate liquidity is high, the collective actions of firms in the M&A markets create the clustering of merger activities and aggregate merger waves. Thus, I expect the takeover activity to be high when aggregate liquidity is high.

#### **4.2.2 Liquidity and Merger Performance**

A substantial amount of studies in M&A focus on the stock performances of target firms and acquiring firms surrounding announcement dates (see, e.g., Asquith (1983), Asquith, Bruner, and Mullins (1983), and Bradley, Desai, and Kim (1988)) and in post-acquisition periods (see, e.g., Franks, Harris, and Titman (1991), Agrawal, Jaffe, and Mandelker (1992), Loughran and Vijh (1997), Rau and Vermaelen (1998), and Agrawal and Jaffe (2000)). Evidence for the announcement period wealth effect on target firms is found to be significantly positive, but either positive or negative for

acquiring firms depending on different takeover characteristics, including method of payment, type of target, etc. On average, acquirers break even in days around merger announcements. For long-term performance, empirical results show that acquiring firms have statistically significant negative abnormal returns up to three (or even five) years after acquisitions, which is widely known as the 'puzzle of post-merger underperformance'.

Harford (1999) explicitly examines the likelihood of acquisitions and corporate liquidity reserves. He finds that firms with high liquidity reserves are more likely to become acquirers than other firms, and acquisitions by cash-rich firms are value-decreasing based on negative stock price reactions to announcements. He further argues that such poor performance by cash-rich firms is consistent with the agency costs of free cash flow hypothesis.<sup>5</sup> Oler (2008), building on Harford's (1999) findings, investigates whether the announcement period market response with respect to the acquirer's liquidity reserves is complete. He proposes that if the initial market response is not complete, then long-term post-acquisition returns will be predictable based on the acquirer's liquidity level. Evidence in Oler (2008) suggests that acquirers with high liquidity balances on the announcement date of acquisitions often suffer negative post-acquisition returns.

Meanwhile, other works have tried to find explanations for long-horizon post-acquisition returns from predictors of stock market returns such as book-to-market ratio and firm size. Rau and Vermaelen (1998) consider the long-term underperformance of bidders in mergers and long-term overperformance of bidders in tender offers. They find that the underperformance of acquiring firms in mergers is caused predominantly by the poor post-acquisition performance of low book-to-market firms. Moeller, Schlingemann, and Stulz (2004) document evidence for the existence of a size effect in acquisition announcement returns and conclude that the announcement

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<sup>5</sup>Jensen and Meckling (1976) and Jensen (1986) argue that the agency conflict between owners and managers is most severe in the presence of large free cash flows, and acquisitions are a primary method by which managers can spend free cash.

return for acquiring-firm shareholders is roughly two percentage points higher for small acquirers. Regarding the method of payment in takeovers, Loughran and Vijh (1997) suggest that the long-term post-acquisition returns for acquirers are higher for cash offers and tender offers than for stock offers and mergers.

Although originating from different areas, these studies show that some predictors of stock market returns can actually be utilised to explain acquisition phenomena and produce fruitful results. Since aggregate liquidity is found to be an important predictor of stock market returns (see Greenwood (2005)), I expect aggregate liquidity to have explanation and prediction power for acquiring firms' performance around and after acquisitions. Inspired by studies on firm liquidity (Harford (1999) and Oler (2008)) and aggregate liquidity (Greenwood (2005) and Harford (2005)), I suggest that aggregate liquidity can also be used to explain abnormal phenomena associated with merger performance. If cash-rich firms are more likely to undertake value-decreasing acquisitions (see Harford (1999)), high aggregate liquidity periods should have more such acquisitions with poor long-term performance.

Some other studies, instead of focusing on acquirers' liquidity levels, explore the effect of target firms' liquidity reserves. They argue that if the market for corporate control monitors liquidity holdings, cash-rich firms should be targeted more frequently, controlling for other factors (see Pinkowitz (2002)).<sup>6</sup> Faleye (2004) finds that proxy fight targets hold 23% more cash than comparable non-targets, and the probability of a contest significantly increases in excess cash holdings. However, Harford (1999) and Pinkowitz (2002) argue that the likelihood of a firm becoming a takeover target is significantly negatively related to the holdings of excess liquidity. Although not directly related to corporate liquidity issues, Schlingemann (2004) analyses the relation between bidder gains and the source of financing funds available. He documents that financing decisions during the year before a takeover play

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<sup>6</sup>However, some studies document that the takeover market does not account for firms' excessive liquidity. See, for example, Ambrose and Megginson (1992), Song and Walkling (1993), and Comment and Schwert (1995).

an important role in explaining the cross section of bidder gains after controlling for the form of payment.

## 4.3 Data Description and Methodology

Section 4.3.1 introduces the construction criteria and provides summary statistics for the sample of mergers. Section 4.3.2 describes how aggregate liquidity is implemented to classify high-, medium-, and low-liquidity markets.

### 4.3.1 The Sample of Mergers

The sample of mergers comes from the Thomson One Banker Mergers and Acquisitions (M&A) Database, which is exactly the same as the Securities Data Corporation (SDC) Mergers and Acquisitions (M&A) Database. Both databases are maintained by the Thomson Financial Services.<sup>7</sup>

I selected a list of completed U.S. acquisitions for domestic targets from the SDC, with announcement dates and effective dates lying between January 1, 1980 and December 31, 2003, respectively. Since the SDC has a very limited cover of U.S. M&A transactions before 1980, I therefore choose 1980 as the starting point of the sample. Ending the sample at 2003 ensures three years' post-merger stock returns are available from the CRSP database. In the literature, Moeller, Schlingemann, and Stulz (2004, 2005) choose a similar sample period when using the SDC database. Data associated with merger deals was collected from the SDC, including acquirers' names and CUSIP codes, the announcements and effective dates of transactions, the transaction values, method of payments (i.e. cash, stock, and mixed), and target firms' public statuses (i.e. public, private and subsidiary). Acquiring firms' stock returns were drawn from the Center for Research in Security Prices (CRSP). However, since

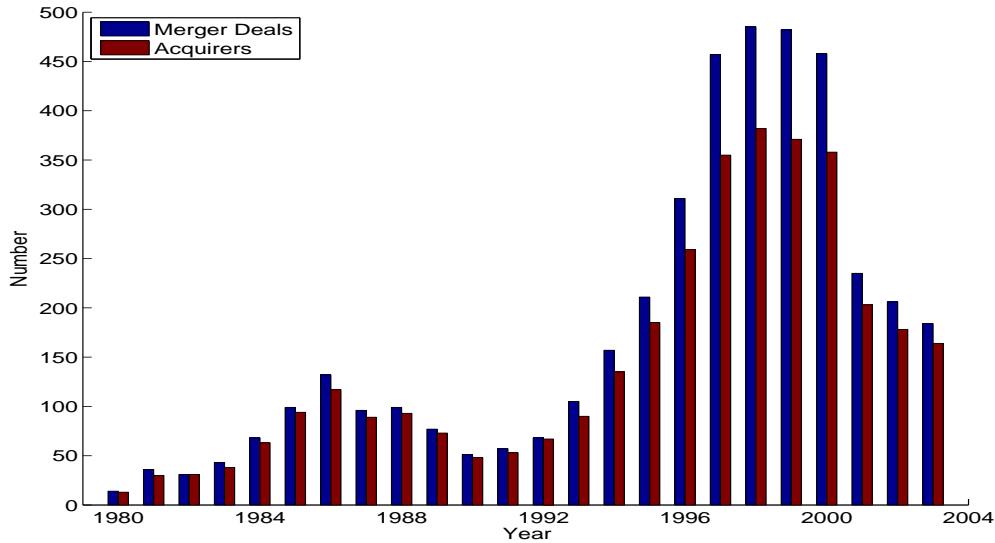
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<sup>7</sup>Discussion with Thomson One Banker employees verified that both databases are the same. For simplicity, I will quote the database in the following discussion as the 'SDC M&A Database' or 'SDC'.

the SDC does not provide the CRSP PERMNO number for the acquiring firms, I searched for PERMNO in CRSP by matching on CUSIP codes.

**Figure 4.1: Annual Number of Merger Deals, 1980 to 2003**

This figure presents the number of merger deals and number of acquiring firms in each year from 1980 to 2003. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million.



For merger transactions to be included into the sample, further requirements are:

1. The sample includes successful bids for at least 50% of the target's equity, and the transaction is listed as completed.
2. The transaction value is equal to or greater than \$100 million, and is defined as the total value of consideration paid by the acquiring firms, excluding fees and expenses.<sup>8</sup>
3. Acquired target firms are public or private U.S. firms, or non-public subsidiaries of a public or private firm.

<sup>8</sup>I employ a one hundred million dollar cut-off to avoid results being driven by small deals. In fact, 49% of my sample firms have a deal value above \$250 million, 27% above \$500 million, and 14% above \$1 billion.

4. Acquiring firms are U.S. firms publicly traded on the American Stock Exchange (AMEX), New York Stock Exchange (NYSE), or Nasdaq.
5. Acquiring firms have daily stock returns around announcement dates and three years' monthly returns after the takeover completion date listed on the CRSP.
6. Neither the acquirer nor the target firm is a financial or utilities institution, because their business involves inventories of marketable securities.

The final sample of mergers after these criteria contains 4,162 merger transactions. Figure 4.1 shows the amount of merger deals in each year between 1980 and 2003. It is obvious that the activity of mergers was high in the late 1980s and slowed down between 1990 and 1993. From that point, the U.S. merger market experienced a significant boom from 1995 up until 2001. Figure 4.1 also shows the annual number of acquiring firms in the sample period.<sup>9</sup> There are only small differences between the number of merger deals and the number of acquirers in the 1980s. However, the gap increased significantly since 1993 and reached its peak in the late 1990s. Note that in this chapter, the terms 'bidder' and 'acquirer' are used interchangeably, because each transaction in the sample leads to a completed acquisition.

Table 4.1 reports the distribution of merger deals through years based on the announcement date of transactions. The amount of mergers increases steadily through time, and has a peak period between 1995 and 2001. Column 3 shows the number of acquiring firms in each year. The total number of acquirers in the sample is 1,955, which means that quite a few acquiring firms in the sample undertook multiple acquisitions.<sup>10</sup> For the whole sample, the average transaction value is \$893.8 million and the median transaction value is \$245.7 million. The large difference between the mean and median values shows that there are more firms with small transaction

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<sup>9</sup>In each year, multiple merger deals carried out by the same firm are counted as one acquiring firm.

<sup>10</sup>Since several acquisitions in different years were undertaken by the same acquiring firm, the total number of acquiring firms is not equal to the sum of the number of acquirers in each year.



**Table 4.1: Yearly Distribution of the Merger Sample**

This table presents the number of mergers, number of acquirers, mean (median) value of transactions (in millions of dollar), the number of mergers classified by method of payment (i.e. pure cash, pure stock, and mixed) and target firms' public status (i.e. public, private, and subsidiary) in each calendar year. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Mean (median) value of transaction is the average (median) transaction value in millions of U.S. dollar as reported by SDC. Pure cash or stock payment refer to transactions that are known to be paid in 100% cash or stock, respectively. Mixed payment transactions include combinations of cash, stocks, and derivative securities. Transactions with unknown type of payment and missing data are omitted from the columns under method of payment.

Year	Number	Number of Acquirers	Transaction Value (\$mil)			Method of Payment				Target Firms' Public Status		
			Mean	Median		Cash	Stock	Mixed		Public	Private	Subsidiary
1980	14	13	379.1	270.3		1	1	10		5	4	5
1981	36	30	321.1	226.1		2	1	30		21	5	10
1982	31	31	277.0	200.0		0	0	30		11	6	14
1983	43	38	318.9	193.0		0	0	41		21	9	13
1984	68	63	323.5	188.8		5	2	55		32	3	30
1985	99	94	696.2	264.0		43	10	27		51	6	41
1986	132	117	439.5	250.0		33	13	27		53	25	54
1987	96	89	487.3	222.1		28	11	26		43	12	41
1988	99	93	563.5	230.0		38	6	23		42	17	38
1989	77	73	612.4	190.0		29	12	18		35	6	34
1990	51	48	621.6	185.5		13	15	14		19	8	24
1991	57	53	354.2	202.4		16	10	24		24	10	22
1992	68	67	357.6	202.2		17	18	22		29	18	21
1993	105	90	786.6	205.0		23	26	35		36	17	50
1994	157	135	630.9	186.9		51	42	36		57	40	58
1995	211	185	652.4	227.1		40	70	69		97	47	64
1996	311	259	691.7	228.0		65	77	114		124	83	100
1997	457	355	661.9	255.0		87	102	179		168	128	159
1998	485	382	1,092.1	232.3		96	121	170		173	151	157
1999	482	371	1,486.7	294.9		96	171	141		194	152	129
2000	458	358	1,511.2	347.4		58	217	127		167	197	91
2001	235	203	1,234.9	300.0		57	49	93		83	72	76
2002	206	178	745.7	211.1		71	27	74		58	65	79
2003	184	164	471.4	179.6		64	15	60		45	60	74
Total	4,162	1,955	893.8	245.7		933	1,016	1,445		1,588	1,141	1,384

values and less with extremely large transaction values.

Table 4.1 also shows the amount of merger deals in each year separated by payment methods and target firms' public status. Based on the method of payment, the whole sample is separated into 933 pure cash payment deals, 1,016 pure stock payment deals, and 1,445 mixed payment transactions. Pure cash or stock payment refers to transactions that are known to be paid in 100% cash or stock, respectively. Mixed payment transactions include combinations of cash, stocks, and derivative securities. Based on target firms' public status, the merger transactions are classified into 1,588 deals with public targets, 1,141 deals with private targets and 1,384 deals with subsidiary targets. Note that the summed number of acquisitions in each subgroup, classified by either the method of payment or target firms' public status, is different from the total number of acquisitions (4,162), which is due to the missing data from the SDC.

### **4.3.2 The Implementation of Aggregate Liquidity**

In this chapter, I will utilise the constructed measures of aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS) to examine the correlations between aggregate liquidity and acquisitions.<sup>11</sup> In particular, I want to examine whether acquisitions announced in high-liquidity markets are fundamentally different from those announced in low-liquidity markets. Therefore, the ways in which I measure and implement the aggregate liquidity to analyse the merger activity and performance are important; a proper empirical methodology should be used to link both sides.

The basic specification is to classify the sample period of mergers as high-, medium-, or low-liquidity markets (or periods) based on the aggregate liquidity measures in the prior year, where acquisitions announced in each liquidity market are

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<sup>11</sup>Section 3.2 in Chapter 3 thoroughly describes the construction of aggregate liquidity measures.

referred to as high-, medium-, or low-liquidity acquisitions. Firstly, the M&A market in a particular year ( $t$ ) is classified as a high-liquidity (30%), medium-liquidity (40%), or low-liquidity (30%) market based on the aggregate liquidity measures the year before ( $t - 1$ ). For the sample period of 1980 to 2004, I have 7 high-liquidity, 10 medium-liquidity, and 7 low-liquidity years (markets). Under this classification, there are two sets of high-, medium-, and low-liquidity markets, based on ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ), respectively.<sup>12</sup> Secondly, acquisitions announced in high-, medium-, or low-liquidity M&A markets are defined as high-, medium-, or low-liquidity (demand or supply) acquisitions.

In summary, merger deals are put into high-, medium-, or low-liquidity portfolios based on the corresponding measures of aggregate liquidity in the year before the announcement of mergers. For example, if the M&A market in year  $t$  is considered a high- (low-) liquidity demand market based on ACLD ( $\Delta L/S$ ) in the prior year  $t - 1$ , then mergers with an announcement date in year  $t$  are put into high- (low-) liquidity demand portfolios. The aggregate liquidity in the year before a takeover plays an important role in explaining merger activity and performance. Since the sample of mergers has a sample period of 1980 to 2003, the time period of aggregate liquidity measures is 1979 to 2002. Table 4.2 presents the summary statistics of aggregate liquidity measures and variables in *flow of funds* for the period of 1979 to 2002. The basic statistical properties of ACLD and AMLS align closely with the results shown in Section 3.2.

In the M&A literature, a similar sample classification method has been applied to examine the correlations between aggregate market conditions and takeovers. Many existing studies in the field of stock market-driven acquisitions (see Shleifer and

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<sup>12</sup>For ACLD ( $\Delta L/S$ ), high-liquidity markets include the years: 2000, 2001, 1984, 1990, 1999, 1997, 1993; medium-liquidity markets include the years: 2002, 1983, 1992, 1996, 1985, 1987, 1994, 1998, 1980; and low-liquidity markets include the years: 1995, 2003, 1981, 1988, 1982, 1989, 1991. For AMLS ( $Debt/GDP$ ), high-liquidity markets include the years: 1994, 1995, 1996, 1997, 1993, 1998, 1992; medium-liquidity markets include the years: 1999, 1991, 1989, 1990, 1988, 2000, 1987, 1986, 2001, 1985; and low-liquidity markets include the years: 2003, 2002, 1984, 1983, 1981, 1982, 1980.

**Table 4.2: Summary Statistics of Aggregate Liquidity, 1979 to 2002**

This table presents the descriptive statistics for aggregate liquidity measures between 1979 and 2002. The sample of aggregate liquidity measures include 24 years' annual aggregate corporate liquidity demand ( $\Delta L/S$ ), which is measured as the ratio of changes in aggregate corporate liquidity ( $\Delta L$ ) to aggregate sources of corporate funds ( $S$ ), and annual aggregate market liquidity supply ( $Debt/GDP$ ), which is measured as the ratio of U.S. publicly held Treasury debt relative to U.S. GDP in that year. The sources of funds ( $S$ ) is the sum of corporate internal funds ( $P - Div$ ), equity issues ( $E$ ), and debt issues ( $D$ ). Panel A reports the number of observations, time-series mean, median, extreme values, first and third quartile, autocorrelation for aggregate liquidity measures. Panel B report the same analysis results for the ratio of each flow of funds variables, including internal funds ( $P - Div$ ), external funds ( $E + D$ ), net equity issues ( $E$ ), net debt issues ( $D$ ), changes in fixed investment ( $\Delta F$ ), changes in inventory investment ( $\Delta I$ ), changes in working capital ( $\Delta W$ ), and changes in residual term ( $\Delta Other$ ), to the aggregate sources of funds ( $S$ ). All variable results are given in percentage terms except for number and autocorrelation. Data is collected from the Federal Reserve *Flow of Funds* Accounts and Henning Bohn's website.

	Number	Mean	Minimum	First Quartile	Median	Third Quartile	Maximum	Standard Deviation	Auto-Correlation
<b>Panel A: Aggregate Liquidity Measures</b>									
Aggregate Corporate Liquidity Demand									
$\Delta L/S$	24	4.69	-1.13	3.15	4.76	6.21	11.53	2.93	0.27
Aggregate Market Liquidity Supply									
$Debt/GDP$	24	38.92	25.65	33.29	40.11	45.88	49.39	7.75	0.89
<b>Panel B: Flow of Funds</b>									
Sources of Funds									
$(P - Div)/S$	24	81.47	69.73	73.81	79.07	86.59	108.69	9.88	0.44
$(E + D)/S$	24	18.53	-8.69	13.41	20.93	26.19	30.27	9.88	0.44
$E/S$	24	-8.57	-28.00	-16.29	-7.36	-0.32	5.36	9.93	0.58
$D/S$	24	27.10	-13.26	22.02	29.69	37.10	46.14	14.88	0.51
Uses of Funds									
$\Delta F/S$	24	81.80	69.44	73.59	81.17	87.92	103.62	8.88	0.50
$\Delta I/S$	24	3.86	-5.31	1.78	4.80	6.49	11.75	3.73	0.05
$\Delta W/S$	24	1.83	-2.75	-1.05	0.78	2.61	15.53	4.73	0.67
$\Delta Other/S$	24	7.83	-10.17	1.62	8.00	16.55	24.69	9.87	0.36

Vishny (2003), Rhodes-Kropf and Viswanathan (2004), and Rhodes-Kropf, Robinson, and Viswanathan (2005)) show a significantly positive correlation between merger waves (activity) and stock market valuation. Notably, Bouwman, Fuller, and Nain (2009) investigate whether acquisitions occurring during booming markets (high P/E ratio of the S&P 500 index) are fundamentally different from those occurring during depressed markets (low P/E ratio of the S&P 500 index). They classify time periods into high-, neutral-, or low-valuation markets based on the detrended P/E ratio, and refer to deals initiated during those periods as high-, neutral-, and low-market acquisitions.

The classification method applied in this research is very similar to that used in Bouwman, Fuller, and Nain (2009), except that the sample of mergers is separated based on annual aggregate liquidity data from the prior year.<sup>13</sup> Unlike market valuation measures (e.g. market indexes and P/E ratio), which are instantly reflected with high frequency, the available data on liquidity demand by corporate sector or liquidity supply by government does not change very much monthly, or even quarterly. Moreover, most of these accounting and economic variables are only updated annually. Therefore, I can only construct annual aggregate liquidity measures and separate merger deals on annual frequency. Another difference is that I apply the prior year's aggregate liquidity to classify takeover markets, instead of the current year's ratio. Firstly, accounting and economic data, used to construct ACLDs and AMLSs, are usually realised and released to the public at the end of each year. Managers can only make takeover decisions based on the prior year's data. Secondly, in the M&A literature, such empirical classification has also been applied when dealing with accounting and economic data. Schlingemann (2004) analyses the relation between bidder gains and the source of financing funds available, documenting that financing decisions during the year before a takeover play an important role in ex-

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<sup>13</sup>Bouwman, Fuller, and Nain (2009) categorise each month by the detrended market P/E of that month.

plaining the cross section of bidder gains.

## 4.4 Merger Activity and Aggregate Liquidity

Why do merger activity and volume change greatly through time? Can aggregate liquidity be applied to explain the merger waves? This section is going to investigate these questions by classifying merger markets as high-, medium-, and low-liquidity markets based on aggregate liquidity.

### 4.4.1 Distribution of Mergers by Aggregate Liquidity

#### *A Single Aggregate Liquidity Separation*

Table 4.3 shows the number and mean transaction value of mergers announced in high-, medium-, and low-liquidity M&A markets, which are classified by measures of ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ). For the whole sample, there is an obvious positive correlation between aggregate liquidity and merger activity, measured by the number of deals or mean transaction value.<sup>14</sup> There are 1,856 mergers announced in high-liquidity demand markets, which have a mean transaction value of \$1,152 million. For the corresponding medium- and low-liquidity demand markets, the number of mergers (mean transaction) drops to 1,611 (\$754) and 695 (\$529), respectively. The right-hand side of Table 4.3 shows the distribution of merger sample by AMLS ( $Debt/GDP$ ). While high-liquidity supply markets contain 1,794 deals, there are only 582 mergers in low-liquidity supply periods. The differences in merger amounts between high- and low-liquidity conditions are positive and over 1,000 for both liquidity measures, and the differences in mean transaction value are \$623 millions for ACLD ( $\Delta L/S$ ) and \$257 millions for AMLS ( $Debt/GDP$ ).

In order to exclude the possibility that this correlation is driven by other factors, I

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<sup>14</sup>Although have not been tabulated in the table, the results of the median transaction value show the same pattern.

**Table 4.3: Merger Sample Distribution by Aggregate Liquidity and Deal Characteristics**

This table presents the number and mean transaction value of mergers for various aggregate liquidity portfolios, which are further divided into target firms' public status (i.e. public, private, subsidiary), method of payment (i.e. cash, stock, mixed), and transaction value (i.e. large (30%), medium (40%), small (30%)). The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. The left (right) panel reports the results for aggregate liquidity demand (supply) portfolios based on  $\Delta L/S$  ( $Debt/GDP$ ). Mean transaction value is shown in millions of U.S. dollars and reported in brackets.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

	Liquidity Demand ( $\Delta L/S$ )					Liquidity Supply ( $Debt/GDP$ )			
	All	High (30%)	Medium (40%)	Low (30%)	Differences in Mean (H-L)	High (30%)	Medium (40%)	Low (30%)	Differences in Mean (H-L)
All Firms	4,162 [894]	1,856 [1,152]	1,611 [754]	695 [529]	[623 <sup>a</sup> ] (4.49)	1,794 [775]	1,786 [1,135]	582 [518]	[257 <sup>b</sup> ] (2.00)
<i>Sorted by Target Firms' Public Status</i>									
Public	1,588 [1,666]	699 [2,188]	614 [1,430]	275 [868]	[1,319 <sup>a</sup> ] (3.86)	684 [1,442]	711 [2,075]	193 [955]	[487] (1.33)
Private	1,141 [318]	577 [378]	413 [275]	151 [209]	[169 <sup>a</sup> ] (5.99)	484 [280]	505 [382]	152 [229]	[50.4 <sup>b</sup> ] (2.38)
Subsidiary	1,384 [491]	559 [666]	569 [379]	256 [357]	[309 <sup>b</sup> ] (2.21)	609 [428]	550 [618]	225 [350]	[77.6] (1.50)
<i>Sorted by Method of Payment</i>									
All Cash	933 [480]	339 [493]	405 [485]	189 [445]	[47.6] (0.69)	379 [489]	411 [519]	143 [342]	[147 <sup>a</sup> ] (2.62)
All Stock	1,016 [1,381]	582 [1,541]	320 [1,326]	114 [719]	[821 <sup>b</sup> ] (2.17)	456 [1,018]	514 [1,642]	46 [2,059]	[−1,041] (−0.79)
Mixed	1,445 [1,112]	644 [1,523]	547 [893]	254 [545]	[978 <sup>a</sup> ] (4.49)	625 [1,056]	520 [1,595]	300 [394]	[661 <sup>a</sup> ] (4.84)
<i>Sorted by Transaction Value</i>									
Large	1,248 [2,509]	635 [2,963]	445 [2,208]	168 [1,586]	[1,377 <sup>a</sup> ] (3.35)	503 [2,253]	614 [2,901]	131 [1,649]	[604] (1.15)
Medium	1,666 [260]	724 [267]	655 [256]	287 [250]	[17.81 <sup>a</sup> ] (3.46)	710 [260]	719 [263]	237 [251]	[8.85] (1.59)
Small	1,248 [125]	497 [126]	511 [125]	240 [123]	[2.78 <sup>b</sup> ] (2.14)	581 [126]	453 [126]	214 [121]	[4.41 <sup>a</sup> ] (3.27)

separate the whole sample and each aggregate liquidity sample into subsamples based on a variety of known deal characteristics, namely the target firms' public status (i.e. public, private, subsidiary), the method of payment (i.e. cash, stock, mixed), and transaction values (i.e. large (30%), medium (40%) or small (30%)), to ascertain the persistence and robustness of the preliminary results. Table 4.3 also reports the number and mean transaction values of the mergers in each subsample; in general, the positive correlation between aggregate liquidity and merger activity remains strong. High-liquidity portfolios contain more merger deals and have larger mean transaction values than corresponding low-liquidity portfolios. For instance, there are 699 (577) acquisitions of public (private) target firms when aggregate liquidity demand ( $\Delta L/S$ ) is high. However, only 275 (151) acquisitions of public (private) target firms are initiated when liquidity demand is low. Furthermore, for each subsample separated by transaction values, high-liquidity markets remain with a larger amount of merger deals than low-liquidity markets. The high and low differentials of transaction value concentrate in the merger subsample with high transaction values.

Subsamples partitioned by aggregate liquidity measures and method of payment generate interesting results. The method of payment in mergers release important information about the true value of acquiring and target firms. On average, cash payments are widely perceived as a positive information signal, while stock payments are believed to convey negative information. For instance, as interpreted by market valuation theories, high market valuation leads to more mergers with stock payments, where firms take advantage of existing opportunities by using overvalued stock as a payment method. For the whole sample, there are 933 acquisitions with cash payment and 1,016 with stock payment. However, the differences in the number and transaction values between high and low liquidity portfolios are much larger for mergers with pure stock payment. In particular, when liquidity demand is high, there are more acquisitions with stock payment (582) and less transactions with cash payment (339). In contrast, when liquidity demand is low, there are less deals with



stock payment (only 114). The results by aggregate liquidity supply also demonstrate such a pattern. Meanwhile, the differences in transaction values are \$48 million for the cash payment subsample and \$822 million for the stock payment subsample.

At firm-level, the scarcity of liquidity usually implies that firms will prefer stock-financed acquisitions rather than cash-financed acquisitions. Although the results in Table 4.3 seem to be opposite to this prediction, there are no contradictions between them. First, when aggregate liquidity is scarce, the economic and investment activities in the whole market should be relatively smaller, which means there are less acquisitions between firms. In such difficult periods, those companies carrying out acquisition performance are more likely to be of good quality, and even firms with consistently sufficient cash holdings; they can take advantage of the bad performance of rivals through cash acquisitions. Second, these high quality acquirers make acquisition decisions under serious considerations, so they are more likely to make better decisions than acquirers who make acquisitions in high-liquidity markets. Consistent with findings in the M&A literature that suggest cash offers deliver better short- and long-run performance, there should be more acquisitions with cash payments when aggregate liquidity is low. Third, when aggregate liquidity is low, both acquirers and targets might experience lower stock performance at the same time. Thus, for acquirers with sufficient liquidity reserves, it is reasonable for them to choose cash-financed acquisitions.

To sum up, the results in Table 4.3 strongly support that higher (lower) aggregate liquidity is accompanied by higher (lower) merger activity in M&A markets. This pattern is significant for both aggregate liquidity measures, and remains robust after controlling some deal characteristics. Moreover, when aggregate liquidity is high, there are more stock payment deals than cash payment deals, while in low-liquidity markets, more mergers are undertaken with pure cash payment.

## ***B Multi Aggregate Liquidity Separation***

To further investigate the correlation between aggregate liquidity and merger activity, I separate merger samples by using both measures of aggregate liquidity. First, I sort the period of merger sample (1980–2003) into two groups (50%, 50%) according to the prior year's ACLD ( $\Delta L/S$ ). Next, I sort each set of observations by the prior year's AMLS ( $Debt/GDP$ ). Based on the announcement date, merger deals are classified into four aggregate liquidity portfolios: high demand-high supply, high demand-low supply, low demand-high supply, and low demand-low supply. Since ACLD and AMLS are positively related to merger activity, therefore classifying merger deals according to both demand and supply factors should generate stronger patterns.

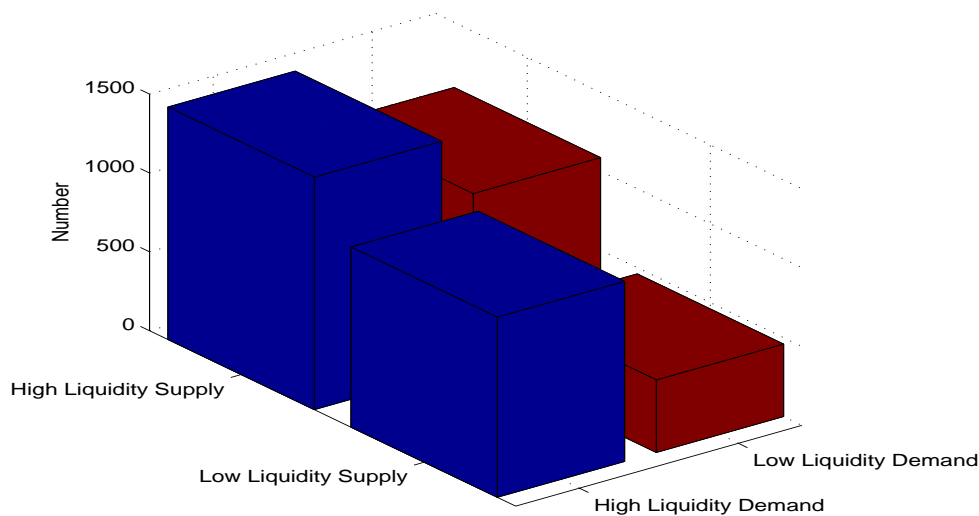
Figure 4.2 shows the distribution of merger samples by applying both ACLD and AMLS. Panel A depicts the number of mergers in each liquidity portfolio. In low  $\Delta L/S$  and low  $Debt/GDP$  M&A markets, the amount of mergers is low. When both ACLD and AMLS are high, there are 1,474 merger deals, which is about three times greater than in low-low liquidity periods (460). Moreover, Panel A shows that the difference in the number of mergers between high and low liquidity demand is greatest when liquidity supply is low. Similarly, the difference in the number of mergers between high and low liquidity supply is greatest when liquidity demand is low. In short, the amount of mergers is highest in a high-high liquidity portfolio, and the number decreases with either liquidity demand or liquidity supply. Panel B depicts the mean transaction value of each constructed liquidity portfolio, where similar patterns have been found.

Recall that mergers with stock payments have stronger positive correlations with aggregate liquidity when compared with cash payment mergers. In terms of market valuation explanations, firms prefer to pay for acquisitions with overvalued stocks rather than cash when the valuation is high. Table 4.3 shows this pattern with a single aggregate liquidity separation. I further examine these correlations by grouping

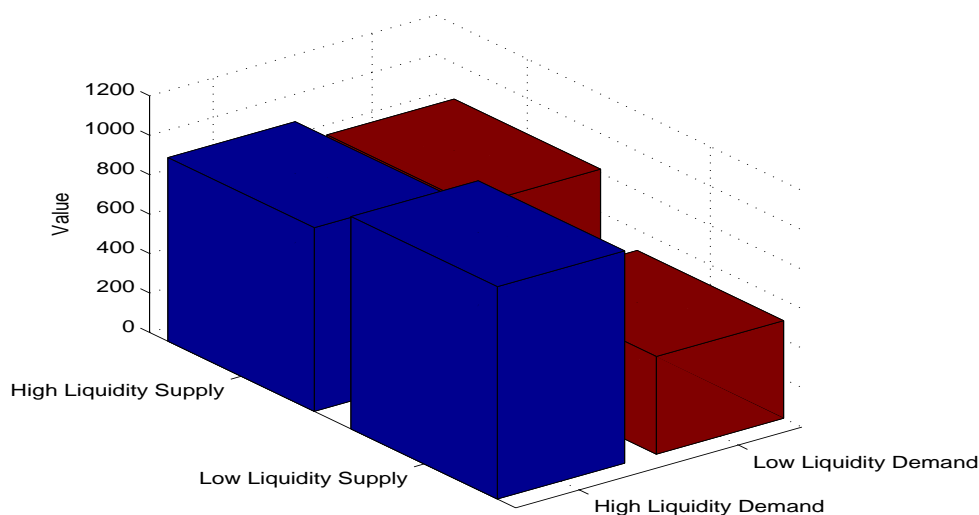
**Figure 4.2: Distribution of Mergers by Aggregate Liquidity Measures**

This figure presents the distribution of mergers by both aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) for the whole merger sample. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals are first sorted into high or low liquidity demand groups according to prior-year  $\Delta L/S$ , then each group of mergers is further sorted into high or low liquidity supply groups according to prior-year  $Debt/GDP$ . Panel A shows the number of mergers in each liquidity portfolio. Panel B shows the mean transaction value of each liquidity portfolio.

**Panel A: Number of Mergers**



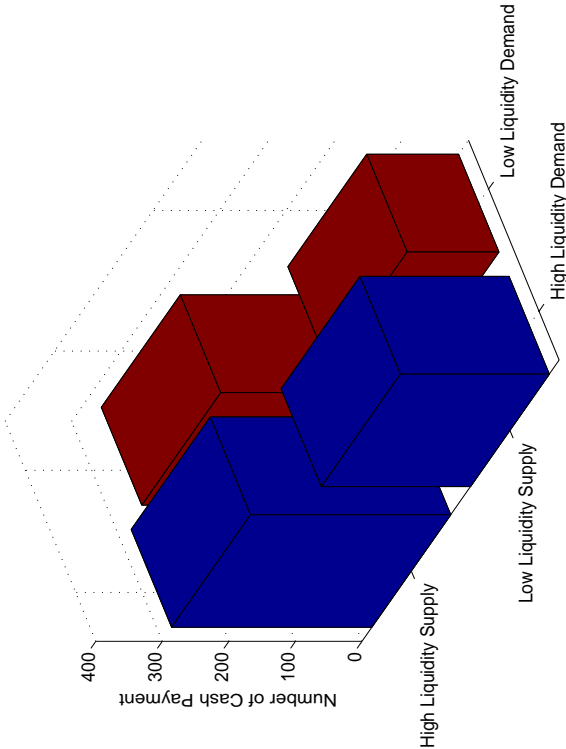
**Panel B: Mean Transaction Value (\$ millions)**



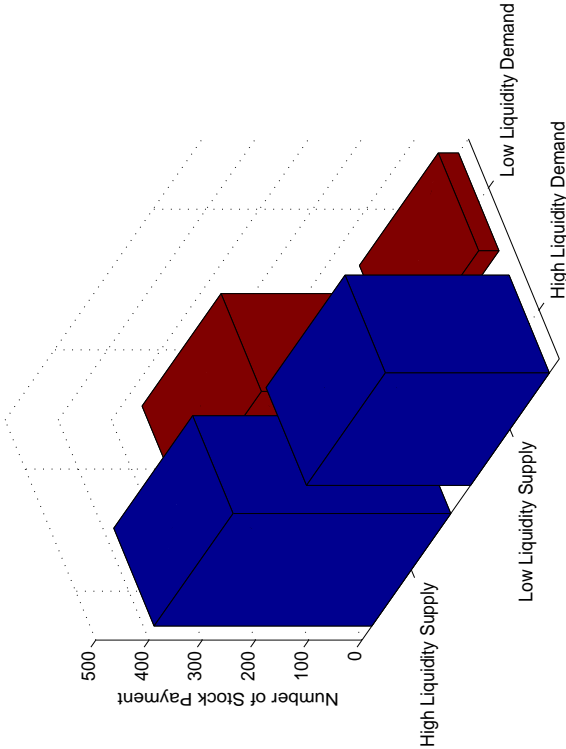
**Figure 4.3: Distribution of Mergers by Aggregate Liquidity and Method of Payment**

This figure presents the distribution of mergers by both aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) for the subsample with pure cash payment (in Panel A) and the subsample with pure stock payment (in Panel B). The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals are first sorted into high or low liquidity demand groups according to prior-year  $\Delta L/S$ , then each group of mergers is further sorted into high or low liquidity supply groups according to prior-year  $Debt/GDP$ . The number of mergers is depicted in the figure.

**Panel A: Mergers with Cash Payment**



**Panel B: Mergers with Stock Payment**



together merger deals with aggregate liquidity demand and supply measures. The merger sample with pure cash (or stock) payments is first sorted into high and low liquidity demand groups by prior year  $\Delta L/S$ , and then each group is further sorted into high and low liquidity supply groups by prior year's  $Debt/GDP$ . The positive correlation between merger activity and aggregate liquidity measures should be more significant for stock payment mergers than for cash payment mergers.

Panel A (Panel B) of Figure 4.3 presents the distribution of cash (stock) payment acquisitions according to aggregate liquidity. When both aggregate liquidity measures are high, there are more stock payment mergers (409) than cash payment mergers (301). However, when both aggregate liquidity measures are low, there are much less mergers with stock payments (38) than with cash payments (138). The differences between high-high liquidity portfolios and low-low liquidity portfolios are 371 for the stock payment subsample, but only 163 for the cash payment subsample. This pattern cannot be explained by differences in the sample size, since the amount of cash payment mergers (933) is similar to that of the stock payment mergers (1,016). Therefore, the distribution of mergers by applying both aggregate liquidity measures simultaneously strengthens the evidence realised in a single liquidity separation. Merger activity is positively related to aggregate liquidity, and the degree of correlation is stronger for mergers with stock payments.

#### 4.4.2 Regression Analysis

In this section, I investigate the correlation between aggregate liquidity and merger activity by using regression analysis. Table 4.4 shows the results of univariate OLS regressions and multivariate regression, where other economic and market factors are used. The dependent variable is the log of the annual number of mergers in the sample. The explanatory variables include aggregate liquidity measures ( $\Delta L/S$  and  $Debt/GDP$ ), GDP growth rate, P/E ratio of the S&P 500 index, and the log of the

**Table 4.4: Regression Analysis of Merger Activity**

This table presents the ordinary least squares regressions of the log of the annual number of mergers on the aggregate liquidity and various other factors. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Panel A shows the results of univariate regressions. The sample of mergers is partitioned into several subsamples based on target firms' public status (i.e. public, private, subsidiary) and method of payment (i.e. cash, stock, mixed). Panel B shows the results of multivariate regressions.  $Liquidity_{t-1}$  is the aggregate liquidity demand ( $\Delta L/S$ ) in column 1-3 or aggregate liquidity supply ( $Debt/GDP$ ) in column 4-6.  $GDP\ Growth_{t-1}$  is the percentage change of U.S. GDP level.  $P/E\ Ratio_{t-1}$  is the P/E ratio of the S&P 500.  $S\&P500\ Index_{t-1}$  is the log of the S&P 500 Composite Index level. The explanatory variables are measured at the end of year  $t-1$ .  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Panel A: Univariate Analysis						
	All	Targets' Public Status			Method of Payment	
		Public	Private	Subsidiary	Cash	Stock
<i>Liquidity Demand</i> <sub><math>t-1</math></sub>	5.84 <sup>b</sup> (2.13)	5.45 <sup>b</sup> (2.07)	7.66 <sup>c</sup> (2.04)	4.59 <sup>c</sup> (1.75)	0.69 (0.27)	6.16 (1.60)
<i>Liquidity Supply</i> <sub><math>t-1</math></sub>	3.36 <sup>a</sup> (3.79)	3.26 <sup>a</sup> (3.90)	4.00 <sup>a</sup> (3.09)	3.26 <sup>a</sup> (4.07)	1.23 (0.94)	4.77 <sup>b</sup> (2.62)
						5.59 <sup>b</sup> (2.48)
						1.67 <sup>c</sup> (1.85)
Panel B: Multivariate Analysis						
	Liquidity Demand			Liquidity Supply		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Liquidity</i> <sub><math>t-1</math></sub>	4.61 <sup>c</sup> (1.86)	-0.74 (-0.37)	0.44 (0.25)	2.62 <sup>b</sup> (2.58)	1.61 <sup>b</sup> (2.41)	1.40 <sup>b</sup> (2.11)
<i>GDP Growth</i> <sub><math>t-1</math></sub>	-7.77 <sup>b</sup> (-2.61)	-2.60 (-1.15)	0.33 (0.14)	-4.54 (-1.41)	-0.67 (-0.31)	1.77 (0.77)
<i>P/E Ratio</i> <sub><math>t-1</math></sub>		0.03 <sup>a</sup> (5.09)			0.03 <sup>a</sup> (5.65)	
<i>S&amp;P500 Index</i> <sub><math>t-1</math></sub>			1.00 <sup>a</sup> (5.47)			0.92 <sup>a</sup> (5.81)
Intercept	2.37 <sup>a</sup> (9.21)	1.65 <sup>a</sup> (7.35)	-0.57 (-1.01)	1.35 <sup>b</sup> (2.50)	0.94 <sup>b</sup> (2.69)	-0.97 <sup>c</sup> (-1.86)

S&P 500 index.<sup>15</sup> These explanatory variables are measured at the end of year  $t - 1$ .

As shown in Panel A of Table 4.4, the coefficients of regression are positive and statistically significant for the complete sample of mergers and most subsamples sorted by various deal characteristics. The positive coefficient suggests a positive correlation between aggregate liquidity and merger activity, which has been found in previous univariate analyses where the sample is split into liquidity portfolios. For the whole sample, the coefficient is 5.84 for liquidity demand and 3.36 for liquidity supply; both values are statistically significant at 5% level. Stock-financed acquisitions show a stronger correlation with aggregate liquidity than cash-financed acquisitions. For instance, the coefficient between stock offers (cash offers) and liquidity supply is 4.77 (1.23) and significant at 5% level (insignificant). Panel B shows the correlation between aggregate liquidity and merger activity after controlling for other factors. For aggregate liquidity supply, the coefficients remain statistically significantly positive after controlling for GDP growth, P/E ratio, or the S&P 500 index. For aggregate liquidity demand, column 4 reports that the correlation between liquidity and activity is 2.62 and significant at 5% level.

Overall, empirical tests by comparing high- and low-liquidity acquisitions, and by running linear regressions, show that aggregate liquidity and merger activity are positively correlated. Higher aggregate liquidity is accompanied by higher merger activity in the aggregate level, especially for stock-financed acquisitions.

## 4.5 Merger Performance and Aggregate Liquidity

As an extension of previous discussions on merger activity and aggregate liquidity, this section examines the effects of liquidity on merger valuation and performance. In particular, this section applies aggregate liquidity to investigate the abnormal

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<sup>15</sup>P/E ratio of the S&P 500 index is collected from Robert J. Shiller's website (<http://www.irrationalexuberance.com/index.htm>).

stock performance of acquiring firms around announcement dates in a short-horizon (in Section 4.5.1) and after the effective date in a long-horizon (in Section 4.5.2).

#### 4.5.1 Announcement Effect Study

By following Fuller, Netter, and Stegemoller (2002) and Dong, Hirshleifer, Richardson, and Teoh (2006), I apply the market-adjusted model to estimate the cumulative abnormal returns (CAR) of acquiring firms' stock for several event windows. For the pre-announcement period, I choose twenty-day  $(-20, -1)$  and forty-day  $(-40, -1)$  event windows, which start twenty (forty) trading days prior to and end one trading day before the announcement date of mergers. For the periods around the announcement date, I use event windows  $(-5, +5)$ ,  $(-2, +2)$ , and  $(-1, +1)$ , where date 0 is the announcement date.

First, daily abnormal returns (AR) are calculated based on the market-adjusted model:

$$AR_{it} = R_{it} - R_{mt} \quad (4.1)$$

where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return of the equally-weighted CRSP index on date  $t$ . Next, daily ARs are accumulated through event dates and across samples. I do not use the market model which estimate market parameters based on a time period before each acquisition, because the presence of frequent acquirers in the sample of mergers (see Table 4.1) suggests a high probability of other acquisition announcements by the same firm in the estimation periods. Any abnormal returns caused by these announcements will bias estimated parameters and make beta estimations less meaningful.

#### *A Pre-Announcement Period*

Table 4.5 shows the acquiring firms' pre-announcement CARs for the whole sample. On average, acquiring firms have positive CAR of 1.38% and 2.48% over one month



and two months before the announcement date of acquisitions, respectively. Both values are statistically significant at 1% level. These results are consistent with the general findings in the M&A literature that acquiring firms experience positive stock returns before announcements, especially for acquisitions with stock payments. Panel A reports the CAR for high-, medium-, and low-liquidity portfolios constructed according to  $\Delta L/S$ . There is a significant trend that pre-announcement CARs decrease in aggregate liquidity demand  $\Delta L/S$  for both event windows. Over event window  $(-40, -1)$ , mergers announced in high-liquidity demand periods have a higher CAR (4.28%) than those initiated in low-liquidity demand markets. The return differential between high- and low-liquidity portfolios is 4.95%, which is statistically significant at the 1% level. Panel B shows the results for various liquidity supply portfolios. The differences in CAR between high- and low-liquidity supply portfolios are also positive and statistically significant.

Although pre-announcement CARs are significantly positive for the whole sample over both event windows, acquisitions in states of low aggregate liquidity (demand and supply) have negative CARs on average. These results suggest that the positive abnormal returns for acquiring firms before merger announcements are mostly driven by mergers announced in high-liquidity M&A markets. Figure 4.4 depicts the pre-announcement CARs of acquiring firms. Panel A (Panel B) shows the average CAR for aggregate liquidity demand (supply) portfolios. The return differences between high- and low-liquidity portfolios are positive and larger for  $\Delta L/S$  partitioned portfolios. Moreover, Panel A shows a strictly positive correlation between aggregate liquidity demand and acquirers' pre-announcement CARs.

To control for known deal characteristics factors, I separate the sample of mergers according to both aggregate liquidity and one other distinct deal characteristic, and re-examine whether mergers announced in high-liquidity markets have larger pre-announcement returns than low-liquidity mergers. Table 4.6 shows the pre-announcement CAR for each subsample, together with the differences in CAR

**Table 4.5: Pre-Announcement Cumulative Abnormal Returns (CAR)**

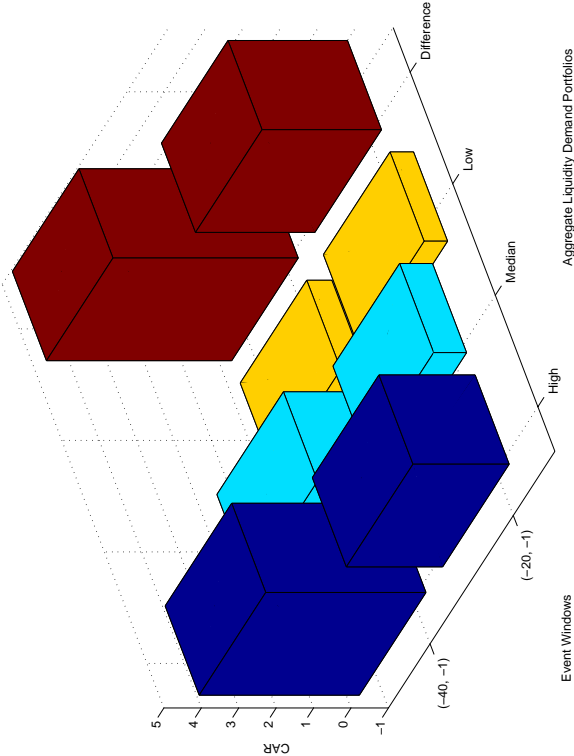
This table presents the acquiring firms' pre-announcement cumulative abnormal returns (CAR) for various aggregate liquidity portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results for liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolios based on  $Debt/GDP$ ). To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-40, -1)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the equally-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over event windows  $(-20, -1)$  and  $(-40, -1)$ , where day 0 is the announcement date. The CAR differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>					
$(-20, -1)$	1.38% <sup>a</sup> (6.30)	2.57% <sup>a</sup> (6.32)	0.88% <sup>a</sup> (3.16)	-0.63% <sup>c</sup> (-1.84)	3.19% <sup>a</sup> (6.03)
$(-40, -1)$	2.48% <sup>a</sup> (7.70)	4.28% <sup>a</sup> (7.39)	1.76% <sup>a</sup> (4.47)	-0.67% (-0.99)	4.95% <sup>a</sup> (5.58)
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>					
$(-20, -1)$	1.38% <sup>a</sup> (6.30)	0.64% <sup>a</sup> (2.60)	2.78% <sup>a</sup> (6.69)	-0.69% (-1.53)	1.34% <sup>a</sup> (2.59)
$(-40, -1)$	2.48% <sup>a</sup> (7.70)	1.38% <sup>a</sup> (3.80)	4.54% <sup>a</sup> (7.69)	-0.40% (-0.47)	1.77% <sup>b</sup> (1.95)

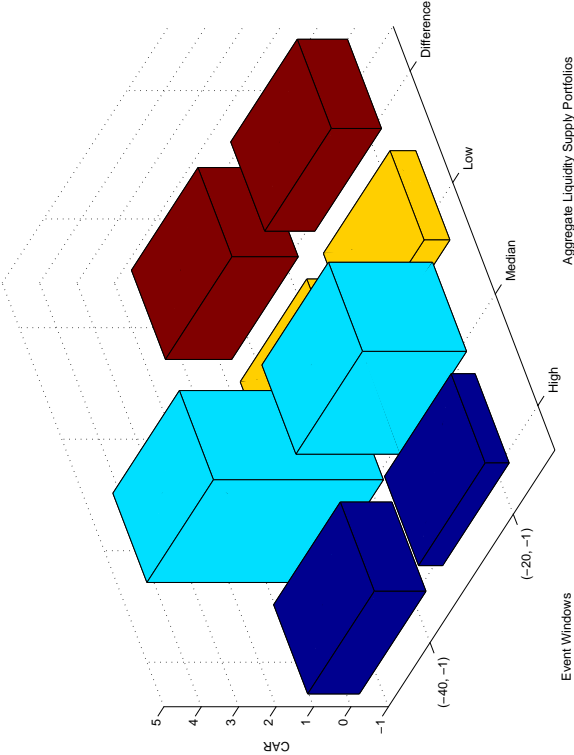
**Figure 4.4: Pre-Announcement Cumulative Abnormal Returns (CAR)**

This figure presents the acquiring firms' pre-announcement cumulative abnormal returns (CAR) for various aggregate liquidity portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results for liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolios based on  $Debt/GDP$ ). To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-40, -1)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return of the equally-weighted CRSP index on date  $t$ . Then CAR is calculated by summing the daily AR over event windows  $(-20, -1)$  and  $(-40, -1)$ , where day 0 is the announcement date. The CAR differentials between high and low liquidity portfolios are reported and labeled as "Difference".

**Panel A: Liquidity Demand ( $\Delta L/S$ ) Portfolios**



**Panel B: Liquidity Supply ( $Debt/GDP$ ) Portfolios**



**Table 4.6: Pre-Announcement CAR sorted by Deal Characteristics**

This table presents the acquiring firms' pre-announcement cumulative abnormal returns (CAR) for various aggregate liquidity portfolios, which are further divided into target firms' public status (i.e. public, private, subsidiary) in Panel A, method of payment (i.e. cash, stock, mixed) in Panel B, and transaction value (i.e. large (30%), medium (40%), small (30%)) in Panel C. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left (right) subpanel reports the results for aggregate liquidity demand (supply) portfolios based on  $\Delta L/S$  ( $Debt/GDP$ ). To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-40, -1)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the equally-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over event windows  $(-20, -1)$  and  $(-40, -1)$ , where day 0 is the announcement date. The CAR differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained by using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significance at the 1, 5, and 10 percent levels, respectively.

Event Windows	Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )				
	High (30%)	Medium (40%)	Low (30%)	Differences (H-L)	High (30%)	Medium (40%)	Low (30%)	Differences (H-L)	
Panel A: Target Firms' Public Status									
Public	(-20, -1)	1.22% <sup>a</sup> (3.67)	2.22% <sup>a</sup> (3.62)	-0.36% (-0.62)	2.57% <sup>a</sup> (3.06)	0.55% (1.41)	2.21% <sup>a</sup> (3.68)	-0.04% (-0.05)	0.58% (0.63)
	(-40, -1)	2.35% <sup>a</sup> (5.15)	3.83% <sup>a</sup> (4.69)	-0.78% (-0.98)	4.61% <sup>a</sup> (4.04)	1.71% <sup>a</sup> (3.01)	3.70% <sup>a</sup> (4.68)	-0.09% (-0.08)	1.80% (1.36)
Private	(-20, -1)	3.00% <sup>a</sup> (5.80)	5.19% <sup>a</sup> (5.69)	-1.25% <sup>c</sup> (-1.86)	6.44% <sup>a</sup> (5.69)	1.14% <sup>b</sup> (2.12)	5.72% <sup>a</sup> (5.75)	-0.29% (-0.33)	1.43% (1.38)
	(-40, -1)	5.60% <sup>a</sup> (6.89)	9.21% <sup>a</sup> (6.83)	-0.07% (-0.03)	9.28% <sup>a</sup> (3.46)	2.26% <sup>a</sup> (2.80)	10.14% <sup>a</sup> (6.93)	0.75% (0.32)	1.50% (0.60)
Subsidiary	(-20, -1)	0.37% (1.18)	0.58% (1.03)	-0.49% (-0.89)	1.06% (1.36)	0.47% (1.19)	1.03% <sup>c</sup> (1.73)	-1.45% <sup>b</sup> (-2.09)	1.93% <sup>b</sup> (2.40)
	(-40, -1)	0.32% (0.71)	0.28% (0.35)	-0.86% (-1.03)	1.14% (0.98)	0.40% (0.71)	0.94% (1.11)	-1.35% (-1.33)	1.75% (1.50)

(continued)

Table 4.6—Continued

Event Windows	Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )			
	High (30%)	Medium (40%)	Low (30%)	Differences (H-L)	High (30%)	Medium (40%)	Low (30%)	Differences (H-L)
Panel B: Method of Payment								
All Cash (−20, −1)	−0.23% (−0.64)	0.52% (0.91)	−1.75% <sup>a</sup> (−2.83)	1.46% <sup>c</sup> (1.64)	0.32% (0.65)	−0.22% (−0.35)	−1.73% <sup>b</sup> (−1.98)	2.04% <sup>b</sup> (2.04)
(−40, −1)	−0.16% (−0.31)	0.74% (0.97)	−3.25% <sup>a</sup> (−3.60)	3.76% <sup>a</sup> (2.97)	0.34% (0.54)	0.43% (0.49)	−3.14% <sup>a</sup> (−2.64)	3.48% <sup>a</sup> (2.58)
All Stock (−20, −1)	4.63% <sup>a</sup> (7.72)	1.93% <sup>a</sup> (2.62)	1.12% (1.19)	5.69% <sup>a</sup> (4.26)	1.92% <sup>a</sup> (3.20)	7.42% <sup>a</sup> (7.22)	0.49% (0.22)	1.43% (0.62)
(−40, −1)	8.16% <sup>a</sup> (9.59)	4.34% <sup>a</sup> (3.95)	2.92% <sup>b</sup> (2.25)	8.39% <sup>a</sup> (4.53)	4.65% <sup>a</sup> (5.12)	12.66% <sup>a</sup> (8.93)	−5.18% <sup>c</sup> (−1.68)	9.83% <sup>a</sup> (3.06)
Mixed (−20, −1)	0.57% <sup>c</sup> (1.67)	0.35% (0.77)	−0.74% (−1.30)	2.01% <sup>b</sup> (2.40)	0.34% (0.81)	1.63% <sup>b</sup> (2.27)	−0.80% (−1.33)	1.14% (1.56)
(−40, −1)	1.13% <sup>b</sup> (2.12)	1.01% (1.58)	0.47% (0.31)	1.03% (0.59)	0.40% (0.69)	1.91% <sup>c</sup> (1.83)	1.30% (0.95)	−0.89% (−0.60)
Panel C: Transaction Value								
Large (−20, −1)	2.15% <sup>a</sup> (5.61)	1.95% <sup>a</sup> (3.82)	−0.03% (−0.04)	2.90% <sup>a</sup> (3.22)	0.90% <sup>b</sup> (2.21)	3.57% <sup>a</sup> (5.28)	0.30% (0.35)	0.60% (0.63)
(−40, −1)	3.36% <sup>a</sup> (6.01)	2.64% <sup>a</sup> (3.62)	−0.65% (−0.63)	5.58% <sup>a</sup> (4.04)	1.29% <sup>b</sup> (2.15)	5.79% <sup>a</sup> (5.91)	−0.08% (−0.06)	1.36% (0.98)
Medium (−20, −1)	0.97% <sup>a</sup> (2.69)	0.36% (0.82)	−0.87% <sup>c</sup> (−1.66)	3.08% <sup>a</sup> (3.58)	0.22% (0.52)	2.11% <sup>a</sup> (3.16)	−0.43% (−0.63)	0.66% (0.81)
(−40, −1)	1.73% <sup>a</sup> (3.51)	1.30% <sup>b</sup> (2.06)	−1.15% (−1.47)	4.44% <sup>a</sup> (3.67)	0.82% (1.36)	3.33% <sup>a</sup> (3.66)	−0.35% (−0.34)	1.17% (0.98)
Small (−20, −1)	1.11% <sup>a</sup> (2.58)	0.58% (1.17)	−0.75% (−1.22)	3.45% <sup>a</sup> (3.41)	0.94% <sup>b</sup> (2.13)	2.77% <sup>a</sup> (3.25)	−1.60% <sup>c</sup> (−1.96)	2.53% <sup>a</sup> (2.73)
(−40, −1)	2.62% <sup>a</sup> (4.14)	1.57% <sup>b</sup> (2.26)	−0.10% (−0.06)	4.98% <sup>b</sup> (2.53)	2.14% <sup>a</sup> (3.21)	4.62% <sup>a</sup> (3.68)	−0.65% (−0.36)	2.79% (1.44)

between corresponding high- and low-liquidity portfolios. I find that the positive correlation between aggregate liquidity and the pre-announcement CAR of acquiring firms remains strong. For each subsample, acquiring firms in high-liquidity portfolios have a positive CAR; however, the values are mostly negative or indifferent from zero for low-liquidity portfolios. As shown in the table, the differences in return between high- and low-liquidity mergers are positive. These patterns are more obvious for liquidity demand ( $\Delta L/S$ ) portfolios.

Panel B of Table 4.6 shows that acquiring firms using stock payments have significantly positive abnormal returns in the two months before a merger announcement, and acquirers with cash payments have returns indifferent from zero. This pattern is consistent with many empirical evidences in the M&A literature. Myers and Majluf (1984) argue that the method of payment forms an information signal. The signalling hypothesis argues that if the acquiring firm believes that its shares are overvalued, it will finance the acquisition with stock to take advantage of such an overvaluation. Therefore, it is reasonable to observe larger positive abnormal returns for stock offers. My intention here is to examine whether the positive CAR differences between high- and low-liquidity mergers remain robust after controlling for the method of payment. For both aggregate liquidity measures, acquiring firms in high-liquidity markets significantly outperform those in low-liquidity markets. Moreover, evidences also indicate that cash offers have smaller differences in returns between high- and low-liquidity markets, while the differences are much larger for stock offers. For event window  $(-40, -1)$ , the CAR differences for mergers with stock payment are 8.39% and 9.83% for liquidity demand portfolios and liquidity supply portfolios, respectively. However, the corresponding differences in CAR for cash payment mergers are only 3.76% and 3.48%. Mixed payment offers provide significant positive returns in high-liquidity states and medium-liquidity states, but only have close to zero or negative returns in low-liquidity states.

Figure 4.5 depicts the results of pre-announcement CARs for cash and stock

offering acquisitions. Subsamples of cash offers and stock offers are further classified into liquidity portfolios. The large differences in returns between high- and low-liquidity portfolios are driven by differences in stock payment acquisitions. Cash offers have small abnormal returns in high liquidity states and negative CARs in low liquidity states. Stock is considered an ‘acquisition currency’ in the period of high aggregate liquidity, because it is more reasonable to use overvalued stock as payment rather than cash. Panel C of Table 4.6 shows the results of CAR after controlling for aggregate liquidity and the level of transaction value. Acquisitions in all three subsamples have similar positive abnormal returns before an announcement. I also find that the differences in CAR are positive and significant, especially for liquidity demand portfolios.

### ***B Around Announcement Date***

As indicated in Table 4.7, I find that all acquisitions in my sample have statistically significant positive returns of 0.75% and 0.84% over event periods  $(-1, +1)$  and  $(-5, +5)$ , respectively. Table 4.8 shows that these results are driven by acquisitions with private or subsidiary targets, which experience significant abnormal performances of 2.56% and 2.58% over event window  $(-2, +2)$ , respectively. Acquisitions with public targets have a significantly negative return of  $-1.89\%$ . Further, Table 4.8 also shows the performance of acquiring firms with various methods of payment. Over period  $(-1, +1)$ , cash acquisitions and mixed offers exhibit significantly positive returns of 1.17% and 1.32%, respectively. However, stock acquisitions deliver a negative 1.08% return, which is significant at the 1% level. These results are consistent with many previous studies.<sup>16</sup>

For the whole sample, Panel A of Table 4.7 shows that high- and medium-liquidity acquirers experience higher abnormal returns than low-liquidity acquirers. Although the differences in CAR between high- and low-liquidity portfolios are positive for

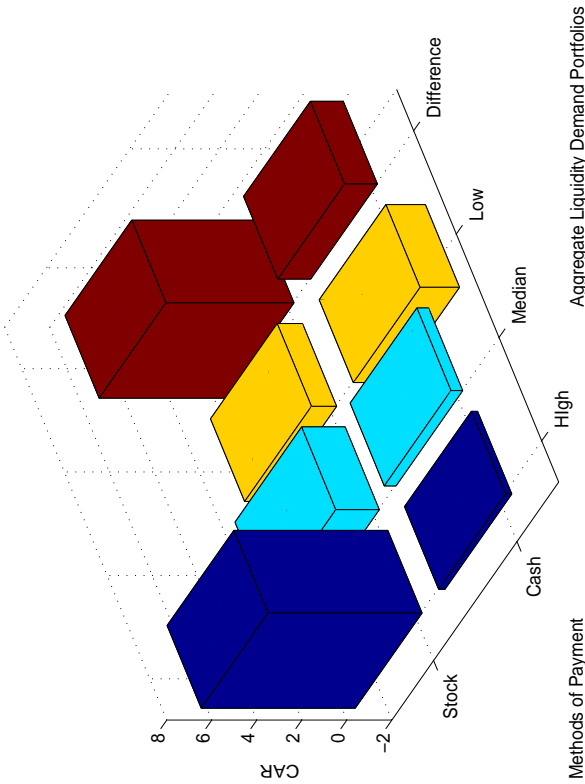
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<sup>16</sup>See Bruner (2002) for a comprehensive literature review on shareholder returns for M&A.

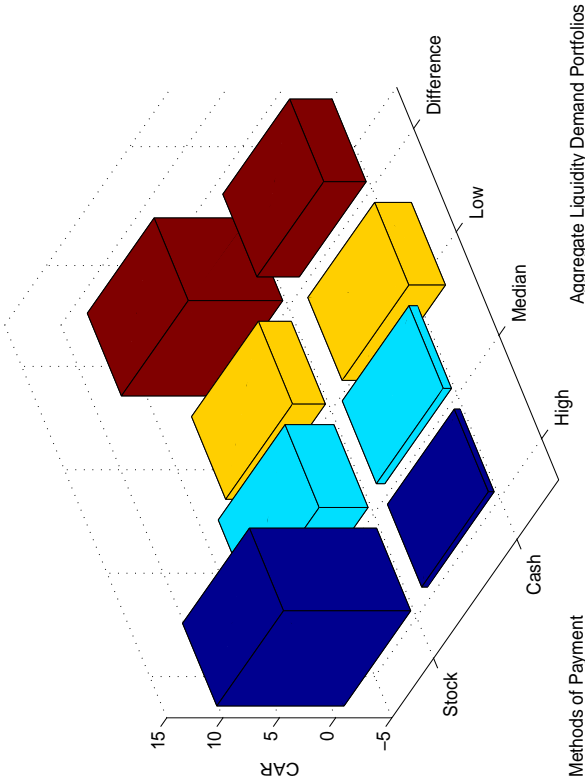
**Figure 4.5: Pre-Announcement CAR sorted by Aggregate Liquidity Demand and Method of Payment**

This figure presents the acquiring firms' pre-announcement cumulative abnormal returns (CAR) for various aggregate liquidity portfolios, which are divided into method of payment (cash and stock). The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A and Panel B show the results of CAR over event windows  $(-20, -1)$  and  $(-40, -1)$ , respectively. To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-40, -1)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return of the equally-weighted CRSP index on date  $t$ . Then CAR is calculated by summing the daily AR over event windows  $(-20, -1)$  and  $(-40, -1)$ , where day 0 is the announcement date. The CAR differentials between high and low liquidity portfolios are reported and labeled as "Difference".

**Panel A: Event Window  $(-20, -1)$**



**Panel B: Event Window  $(-40, -1)$**





**Table 4.7: Announcement Period Cumulative Abnormal Returns (CAR)**

This table presents the acquiring firms' announcement period cumulative abnormal returns (CAR) for various aggregate liquidity portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results for liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolios based on  $Debt/GDP$ ). To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-5, +5)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the equally-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over event windows  $(-1, +1)$ ,  $(-2, +2)$ , and  $(-5, +5)$ , where day 0 is the announcement date. The CAR differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>					
$(-5, +5)$	0.89% <sup>a</sup> (3.92)	0.71% <sup>c</sup> (1.69)	1.42% <sup>a</sup> (4.91)	0.14% (0.37)	0.57% (1.02)
$(-2, +2)$	0.84% <sup>a</sup> (4.29)	0.52% (1.43)	1.39% <sup>a</sup> (5.74)	0.37% (1.19)	0.15% (0.31)
$(-1, +1)$	0.75% <sup>a</sup> (4.22)	0.47% (1.39)	1.23% <sup>a</sup> (5.70)	0.39% (1.37)	0.08% (0.19)
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>					
$(-5, +5)$	0.89% <sup>a</sup> (3.92)	1.51% <sup>a</sup> (5.54)	0.55% (1.28)	0.04% (0.1)	1.46% <sup>a</sup> (2.83)
$(-2, +2)$	0.84% <sup>a</sup> (4.29)	1.44% <sup>a</sup> (6.18)	0.42% (1.12)	0.24% (0.69)	1.20% <sup>a</sup> (2.89)
$(-1, +1)$	0.75% <sup>a</sup> (4.22)	1.37% <sup>a</sup> (6.74)	0.34% (0.98)	0.09% (0.28)	1.28% <sup>a</sup> (3.47)

**Table 4.8: Announcement Period CAR sorted by Deal Characteristics**

This table presents the acquiring firms' announcement period cumulative abnormal returns (CAR), which are further divided into target firms' public status (i.e. public, private, subsidiary), method of payment (i.e. cash, stock, mixed), and transaction value (i.e. large (30%), medium (40%), small (30%)). The left subpanel reports the results for the whole sample. The middle (right) subpanel reports the differences in CAR between high and low liquidity demand (supply) portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t+1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. To calculate CAR, the daily abnormal returns (AR) for acquiring firm over days  $(-5, +5)$  are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the equally-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over event windows  $(-1, +1)$ ,  $(-2, +2)$ , and  $(-5, +5)$ , where day 0 is the announcement date. The CAR differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significance at the 1, 5, and 10 percent levels, respectively.

Deal Characteristics	Whole Sample			Differences in CAR (by $\Delta L/S$ )			Differences in CAR (by $Debt/GDP$ )		
	$(-5, +5)$	$(-2, +2)$	$(-1, +1)$	$(-5, +5)$	$(-2, +2)$	$(-1, +1)$	$(-5, +5)$	$(-2, +2)$	$(-1, +1)$
<b>Sorted by Target Firms' Public Status</b>									
Public	-1.67% <sup>a</sup> (-5.58)	-1.89% <sup>a</sup> (-7.29)	-1.71% <sup>a</sup> (-7.38)	-0.76% (-0.96)	-1.82% <sup>b</sup> (-2.54)	-1.60% <sup>b</sup> (-2.45)	-0.58% (-0.64)	-0.58% (-0.77)	0.03% (0.05)
Private	2.66% <sup>a</sup> (5.69)	2.56% <sup>a</sup> (6.87)	2.21% <sup>a</sup> (6.81)	1.45% (1.26)	0.76% (0.86)	0.31% (0.39)	3.37% <sup>a</sup> (3.44)	2.63% <sup>a</sup> (3.33)	2.69% <sup>a</sup> (4.14)
Subsidiary	2.51% <sup>a</sup> (5.75)	2.58% <sup>a</sup> (6.72)	2.38% <sup>a</sup> (6.51)	1.27% (1.18)	1.75% <sup>c</sup> (1.87)	1.76% <sup>b</sup> (1.97)	2.67% <sup>a</sup> (3.12)	2.40% <sup>a</sup> (3.72)	2.03% <sup>a</sup> (3.61)
<b>Sorted by Method of Payment</b>									
All Cash	0.96% <sup>a</sup> (2.69)	1.26% <sup>a</sup> (4.35)	1.17% <sup>a</sup> (4.92)	1.08% (1.16)	0.87% (1.11)	0.78% (1.15)	2.25% <sup>b</sup> (2.24)	1.71% <sup>b</sup> (2.18)	1.24% <sup>c</sup> (1.83)
All Stock	-0.52% (-0.96)	-1.09% <sup>b</sup> (-2.39)	-1.08% <sup>a</sup> (-2.67)	0.29% (0.21)	-0.50% (-0.42)	-0.41% (-0.37)	2.35% (1.17)	0.82% (0.49)	2.42% (1.41)
Mixed	1.30% <sup>a</sup> (3.06)	1.48% <sup>a</sup> (3.88)	1.32% <sup>a</sup> (3.61)	-0.16% (-0.15)	0.16% (0.18)	0.03% (0.04)	1.24% <sup>c</sup> (1.65)	1.55% <sup>b</sup> (2.54)	1.71% <sup>a</sup> (3.26)
<b>Sorted by Transaction Value</b>									
Large	0.19% (0.38)	-0.35% (-0.76)	-0.28% (-0.64)	-0.10% (-0.09)	-1.03% (-1.00)	-0.45% (-0.45)	-0.25% (-0.29)	-0.18% (-0.26)	0.49% (0.72)
Medium	0.91% <sup>a</sup> (2.88)	1.06% <sup>a</sup> (3.95)	0.84% <sup>a</sup> (3.84)	0.73% (0.92)	0.60% (0.87)	0.23% (0.41)	0.71% (0.84)	1.05% (1.49)	0.96% (1.60)
Small	1.58% <sup>a</sup> (4.22)	1.72% <sup>a</sup> (5.88)	1.67% <sup>a</sup> (6.3)	1.22% (1.27)	1.17% (1.57)	0.82% (1.21)	3.87% <sup>a</sup> (4.20)	2.68% <sup>a</sup> (3.88)	2.54% <sup>a</sup> (4.11)

three event windows, none of them is statistically significant. As indicated in Panel B, the differences between three-day, five-day, and ten-day CARs for high- and low-liquidity acquirers are 1.28%, 1.20%, and 1.46%, which are all statistically significant at 1% level. Consistent with previous results for pre-announcement period abnormal returns, these results suggest that the market is less welcoming of acquisitions during low-liquidity M&A markets than during high-liquidity markets.

When the entire sample is partitioned by aggregate liquidity and target firms' public status, as shown in Table 4.8, the results indicate that the differences in CAR between high- and low-liquidity acquirers are positive and significant for acquisitions with subsidiary targets. However, the return differences between high- and low-liquidity demand (supply) portfolios are significantly negative (indifferent from zero) for acquisitions with public targets. Table 4.8 also shows abnormal performances for cash, stock, and mixed acquisitions. These results indicate that differences in returns, when partitioned by aggregate liquidity supply, are positive across all payment methods and event windows; stock payment offers do not have larger return difference when compared to cash payment acquisitions.

In summary, the results for pre-announcement CARs strongly suggest that mergers announced in high-liquidity markets are substantially different from those initiated in low-liquidity markets, where high- and medium-liquidity acquisitions experience significantly positive abnormal returns, while low-liquidity acquisitions have significantly lower CARs. There is a strong positive correlation between aggregate liquidity and pre-announcement CARs for acquiring firms, and this pattern remains significant even after controlling for various deal characteristics. It seems that the commonly recognised positive abnormal returns for acquiring firms before the announcement date are mostly driven by high-liquidity mergers. For abnormal performance measured around the announcement period, the results indicate that high-liquidity acquirers outperform low-liquidity acquirers over three event windows. In general, the market seems to look more favourably upon high-liquidity acquisitions

than low-liquidity acquisitions in the periods before and around merger announcement dates.

### **4.5.2 Post-Merger Long-term Performance Analysis**

It is equally important to investigate the long-term performance of acquirers, which has been widely recognised in the literature to have negative abnormal returns up to three (or even five) years after acquisitions. In this section, I intend to examine whether the long-term underperformance of acquirers can be explained by aggregate liquidity factors. In particular, I examine whether the long-term performance of acquisitions announced in high-liquidity markets is significantly different from that announced in low-liquidity markets. I partition the whole merger sample and each merger subsample, which are sorted by deal characteristics, into corresponding high-, medium-, and low-liquidity portfolios. Following this, the long-run stock returns of acquiring firms are estimated and compared.

There have been many debates about the proper estimation of long-term abnormal returns. Started by Ritter (1991), the most popular method for measuring long-term abnormal performance is the buy-and-hold abnormal return (BHAR). Although this method has been met with a number of concerns, it is nevertheless supported by many researchers and widely used in empirical research. Another well-recognised methodology is the calendar-time portfolio regression (CTPR) approach, which is strongly supported by Fama (1998) and Mitchell and Stafford (2000). To avoid any bias in methodology, I therefore apply both methods to estimate long-run abnormal performance.

#### ***A Buy-and-Hold Abnormal Returns (BHAR)***

Estimating long-term abnormal performance with buy-and-hold abnormal returns (BHAR) is advocated by Barber and Lyon (1997) and Kothari and Warner (1997).

The long-term BHAR is calculated as the long-term buy-and-hold return (BHR) of a sample firm less the long-term BHR of a reference portfolio:

$$BHAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N (BHR_{i, (T_1, T_2)} - BHR_{p_i, (T_1, T_2)}) \quad (4.2)$$

where

$$BHR_{i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{it}) - 1. \quad (4.3)$$

$$BHR_{p_i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} \left[ 1 + \frac{\sum_{j=1}^{N_t} R_{jt}}{N_t} \right] - 1 \quad (4.4)$$

$BHR_{i, (T_1, T_2)}$  is the BHR for firm  $i$  over period  $T_1$  to  $T_2$ .  $BHR_{p_i, (T_1, T_2)}$  is the BHR for firm  $i$ 's size and book-to-market reference portfolio over period  $T_1$  to  $T_2$ .  $N$  is the number of firms in the sample.  $T_2 - T_1$  is the horizon in months over which abnormal returns are calculated. 12 months, 24 months, and 36 months post-merger BHAR are measured over months  $(+1, +12)$ ,  $(+1, +24)$ , and  $(+1, +36)$ , respectively, where month 0 is the completion month of acquisitions. Size and book-to-market reference portfolios are constructed by following Fama and French (1993). The equally-weighted monthly returns of 25 reference portfolios formed on size and book-to-market  $(5 \times 5)$  are downloaded from Kenneth French's website.<sup>17</sup> Acquiring firms are assigned to 25 reference portfolios using the breakpoints for size and book-to-market. The BHAR captures the value of investing in acquiring firms relative to a matched benchmark over the estimation period.

Table 4.9 shows the BHAR results for the whole sample of mergers. On average, acquirers in mergers have a significantly negative abnormal performance in the long-horizon after the completion of acquisitions. As indicated in Table 4.9, acquisitions have a negative return of  $-6.02\%$  over a one-year post-merger period, while two-year and three-year post-merger BHARs are  $-9.38\%$  and  $-11.62\%$ , respectively. Each

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<sup>17</sup>Data is downloaded from Kenneth French's website (<http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>).

**Table 4.9: Post-Merger Buy-and-Hold Abnormal Returns (BHAR)**

This table presents the acquiring firms' post-merger buy-and-hold abnormal returns (BHAR) for various aggregate liquidity portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t+1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results of liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolios based on  $Debt/GDP$ ). To calculate BHAR, I first calculate the buy-and-hold returns (BHR) for each event firm for a period ranging from 1 month to 12, 24, or 36 month, respectively, where month 0 is the effective month in mergers:  $BHR_{iT} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  simple return on firm  $i$ , and  $T$  is the horizon over which the  $BHR_{iT}$  is computed. Then the BHR for a reference portfolio is calculated as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{N_t} R_{jt}/N_t] - 1$ , where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $N_t$  is the number of firms in the reference portfolio in month  $t$ , and  $R_{jt}$  is the return for firm  $j$  in the reference portfolio during the event-month  $t$  for event firm  $i$ . The mean BHAR are then calculated as  $BHAR_T = \frac{1}{N} \sum_{i=1}^N (BHR_{iT} - BHR_{p_i,T})$ , where  $N$  is the number of event firms that have valid BHR for event period 12, 24, or 36 months. The differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

	Event Windows	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
Panel A: Liquidity Demand ( $\Delta L/S$ )						
All Firms	1 Year	-6.02% <sup>a</sup>	-9.88% <sup>a</sup>	-4.86% <sup>a</sup>	1.34%	-11.22% <sup>a</sup>
		(-7.11)	(-7.05)	(-3.74)	(0.83)	(-5.27)
	2 Years	-9.38% <sup>a</sup>	-13.14% <sup>a</sup>	-9.97% <sup>a</sup>	1.49%	-14.63% <sup>a</sup>
		(-7.70)	(-7.22)	(-4.98)	(0.53)	(-4.39)
	3 Years	-11.62% <sup>a</sup>	-16.06% <sup>a</sup>	-11.92% <sup>a</sup>	0.29%	-16.35% <sup>a</sup>
		(-7.51)	(-7.43)	(-4.59)	(0.07)	(-3.64)
Panel B: Liquidity Supply ( $Debt/GDP$ )						
All Firms	1 Year	-6.02% <sup>a</sup>	-5.08% <sup>a</sup>	-8.47% <sup>a</sup>	-1.61%	-3.48% <sup>c</sup>
		(-7.11)	(-3.89)	(-6.14)	(-1.01)	(-1.68)
	2 Years	-9.38% <sup>a</sup>	-13.38% <sup>a</sup>	-7.45% <sup>a</sup>	-3.26%	-10.12% <sup>a</sup>
		(-7.70)	(-6.12)	(-4.63)	(-1.3)	(-3.04)
	3 Years	-11.62% <sup>a</sup>	-17.90% <sup>a</sup>	-7.96% <sup>a</sup>	-4.54%	-13.35% <sup>a</sup>
		(-7.51)	(-6.42)	(-4.00)	(-1.28)	(-2.96)

of these BHARs is statistically significant at the 1% level. These results are consistent with previous findings in the M&A literature, where acquiring firms experience significantly negative long-term stock performance after acquisitions.

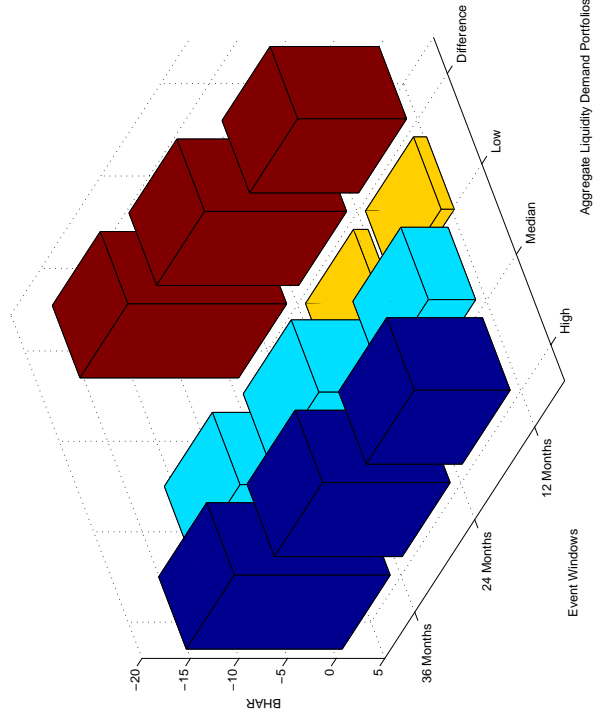
When the sample of mergers is partitioned by aggregate liquidity, I find strong evidence that aggregate liquidity does affect acquirers' long-term performance. Panel A of Table 4.9 reports BHAR results for various liquidity demand portfolios. Acquisitions in high-liquidity demand portfolios exhibit the largest negative performance of  $-9.88\%$ ,  $-13.14\%$ , and  $-16.06\%$  in one-year, two-year, and three-year post-merger periods, respectively. However, the degree of underperformance is much smaller for mergers initiated in low-liquidity periods. For instance, even acquiring firms in low-liquidity portfolios have a positive BHAR of  $0.29\%$  over three years after acquisition. The strikingly large differences in post-merger BHARs between high- and low-liquidity demand portfolios ( $-11.22\%$  for 12 months,  $-14.63\%$  for 24 months and  $-16.35\%$  for 36 months) suggest that the commonly recognised long-run underperformance of acquiring firms is mainly driven by acquisitions announced in high-liquidity markets. Panel B of Table 4.9 shows the BHAR results for various liquidity supply portfolios. I find that high- and medium-liquidity acquirers have statistically significant negative returns after acquisitions, while low-liquidity acquirers only have returns indifferent from zero. The differences in BHAR are  $-3.48\%$  for 12 months,  $-10.12\%$  for 24 months, and  $-13.35\%$  for 36 months, which are all statistically significant.

The results in Table 4.9 show that mergers announced in the high-liquidity periods destroy the value for shareholders of acquiring firms in the long run, while low-liquidity mergers do not. Long-term BHARs are negatively related to aggregate liquidity demand and supply. Figure 4.6 depicts the patterns of abnormal returns across aggregate liquidity and post-merger event windows. The 'ladder'-shaped BHAR reflects that the magnitude of negative BHAR is positively correlated with the length of post-merger period and the degree of aggregate liquidity. In addition,

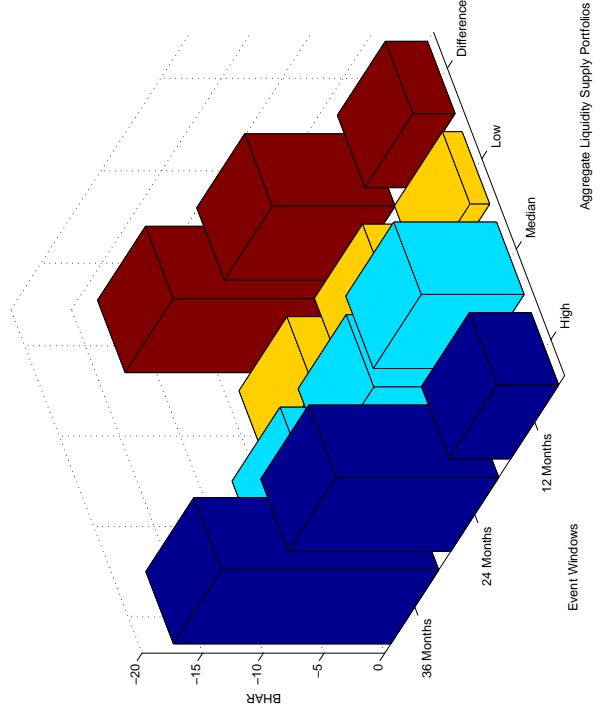
**Figure 4.6: Post-Merger Buy-and-Hold Abnormal Returns**

This figure presents the acquiring firms' post-merger buy-and-hold abnormal returns (BHAR) for various aggregate liquidity portfolios. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results of liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolio based on  $Debt/GDP$ ). To calculate BHAR, I first calculate the buy-and-hold returns (BHR) for each event firm for a period ranging from 1 month to 12, 24, or 36 months, respectively, where month 0 is the effective month in mergers:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  simple return on firm  $i$ , and  $T$  is the horizon over which the  $BHR_{i,T}$  is computed. Then the BHR for a reference portfolio is calculated as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{N_t} R_{jt}/N_t] - 1$ , where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $N_t$  is the number of firms in the reference portfolio in month  $t$ , and  $R_{jt}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$  for event firm  $i$ . The mean BHAR are then calculated as  $BHAR_T = \frac{1}{N} \sum_{i=1}^N (BHR_{i,T} - BHR_{p_i,T})$ , where  $N$  is the number of event firms that have valid BHR for event period 12, 24, or 36 months. The differentials between high and low liquidity portfolios are reported and labeled as "Difference".

**Panel A: Liquidity Demand ( $\Delta L/S$ ) Portfolios**



**Panel B: Liquidity Supply ( $Debt/GDP$ ) Portfolios**





the large positive differences in long-term returns between high- and low-liquidity mergers are clearly shown.

To further investigate these correlations, I examine the abnormal returns of acquisitions in subsamples classified by aggregate liquidity and various deal characteristics. In general, as shown in Table 4.10, acquiring firms' post-merger BHARs are negatively correlated with aggregate liquidity, which suggests that the main pattern remains robust after controlling for common deal characteristics. Panel A of Table 4.10 reports the results of BHAR when the sample of mergers is partitioned by aggregate liquidity and target firms' public status (i.e. public, private, subsidiary). Acquirers purchasing public and private targets have larger negative abnormal returns in the long horizon. For instance, three-year BHARs are  $-15.95\%$  and  $-13.49\%$  for acquisitions with public and private targets, respectively, while the abnormal returns are only  $-4.43\%$  for buying subsidiary firms. Regardless of target firms' public status and aggregate liquidity measures, acquisitions in low-liquidity portfolios have the smallest negative post-merger returns. The differences in BHAR between high-liquidity portfolios and corresponding low-liquidity portfolios are negative and mostly statistically significant.

Panel B of Table 4.10 shows the results of subsamples partitioned on the basis of aggregate liquidity and the method of payment. The evidence shows that all acquiring firms with stock payment experience much larger negative long-term returns than cash payment acquisitions. The three-year BHAR is  $-26.14\%$  for acquirers using pure stock as a payment method. However, the corresponding return is only  $-3.12\%$  for cash payment acquisitions. Recall that, in pre-announcement periods, stock offers are found to have larger positive abnormal returns than cash offers. Considering the pre-announcement CAR in conjunction with the post-merger BHAR, these results suggest the existence of active timing of valuation in M&A, that stock offers are carried out when pre-announcement stock returns are positive. Managers take advantage of this high valuation before merger announcements with

**Table 4.10: Post-Merger BHAR sorted by Deal Characteristics**

This table presents the acquiring firms' post-merger buy-and-hold abnormal returns (BHAR) for various aggregate liquidity portfolios, which are further divided into target firms' public status (i.e. public, private, subsidiary) in Panel A, method of payment (i.e. cash, stock, mixed) in Panel B, and transaction value (i.e. large (30%), medium (40%), small (30%)) in Panel C. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left (right) subpanel reports the results for aggregate liquidity demand (supply) portfolios based on  $\Delta L/S$  ( $Debt/GDP$ ). To calculate BHAR, I first calculate the buy-and-hold returns (BHR) for each event firm for a period ranging from 1 month to 12, 24, or 36 months, respectively, where month 0 is the effective month in mergers:  $BHR_{it} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  simple return on firm  $i$ , and  $T$  is the horizon over which the  $BHR_{it}$  is computed. Then the BHR for a reference portfolio is calculated as  $BHR_{p_i, T} = \prod_{t=1}^T [1 + \sum_{j=1}^{N_t} R_{jt}/N_t] - 1$ , where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $N_t$  is the number of firms in the reference portfolio in month  $t$ , and  $R_{jt}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$  for event firm  $i$ . The mean BHAR are then calculated as  $BHAR_T = \frac{1}{N} \sum_{i=1}^N (BHR_{it} - BHR_{p_i, T})$ , where  $N$  is the number of event firms that have valid BHR for event period 12, 24, or 36 months. The differentials between high liquidity portfolios and low liquidity portfolios are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	All	Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )			
		High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
Panel A: Target Firms' Public Status									
Public	1 Year	-7.37% <sup>a</sup> (-6.04)	-7.57% <sup>a</sup> (-4.01)	-4.67% <sup>c</sup> (-1.89)	-3.58% (-1.13)	-8.73% <sup>a</sup> (-4.47)	-7.50% <sup>a</sup> (-4.06)	-2.13% (-0.83)	-6.59% <sup>b</sup> (-2.04)
	2 Years	-11.77% <sup>a</sup> (-6.13)	-11.65% <sup>a</sup> (-3.69)	-7.74% <sup>c</sup> (-1.83)	-5.76% (-1.12)	-18.18% <sup>a</sup> (-5.39)	-6.80% <sup>a</sup> (-2.73)	-6.93% (-1.53)	-11.25% <sup>b</sup> (-1.99)
	3 Years	-15.95% <sup>a</sup> (-6.62)	-17.79% <sup>a</sup> (-4.27)	-9.12% (-1.46)	-7.97% (-1.13)	-25.86% <sup>a</sup> (-6.27)	-8.23% <sup>a</sup> (-2.57)	-9.66% (-1.56)	-16.20% <sup>b</sup> (-2.18)
<i>(continued)</i>									

(continued)

**Table 4.10**—*Continued*

		Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )				
Event Windows		All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
Private	1 Year	–6.65% <sup>a</sup> (–3.36)	–11.84% <sup>a</sup> (–3.67)	–3.79% (–1.32)	3.95% (1.09)	–15.79% <sup>a</sup> (–3.25)	–2.54% (–0.90)	–12.06% <sup>a</sup> (–3.51)	–2.27% (–0.67)	–0.27% (–0.06)
	2 Years	–13.30% <sup>a</sup> (–5.52)	–17.00% <sup>a</sup> (–5.12)	–12.15% <sup>a</sup> (–2.82)	–3.46% (–0.64)	–13.54% <sup>b</sup> (–2.14)	–14.26% <sup>a</sup> (–3.18)	–15.63% <sup>a</sup> (–5.09)	–3.36% (–0.69)	–10.90% <sup>c</sup> (–1.64)
	3 Years	–13.49% <sup>a</sup> (–4.37)	–18.65% <sup>a</sup> (–4.45)	–10.64% <sup>c</sup> (–1.94)	–2.85% (–0.37)	–15.80% <sup>c</sup> (–1.79)	–16.28% <sup>a</sup> (–2.72)	–14.73% <sup>a</sup> (–4.00)	–2.12% (–0.32)	–14.16% (–1.58)
Subsidiary	1 Year	–3.85% <sup>a</sup> (–2.81)	–10.01% <sup>a</sup> (–4.61)	–2.40% (–1.08)	6.24% <sup>b</sup> (2.39)	–16.25% <sup>a</sup> (–4.79)	–2.50% (–1.12)	–6.94% <sup>a</sup> (–3.25)	–0.10% (–0.04)	–2.40% (–0.70)
	2 Years	–2.89% (–1.37)	–7.91% <sup>b</sup> (–2.39)	–6.13% <sup>c</sup> (–1.89)	14.58% <sup>a</sup> (2.93)	–22.49% <sup>a</sup> (–3.76)	–6.35% <sup>c</sup> (–1.68)	–0.34% (–0.12)	0.02% (0.01)	–6.37% (–1.17)
	3 Years	–4.43% <sup>c</sup> (–1.64)	–11.91% <sup>a</sup> (–2.94)	–5.39% (–1.29)	13.07% <sup>c</sup> (1.92)	–24.97% <sup>a</sup> (–3.16)	–8.35% <sup>c</sup> (–1.71)	–1.15% (–0.32)	–2.42% (–0.42)	–5.93% (–0.79)
Panel B: Method of Payment										
All Cash	1 Year	–4.54% <sup>a</sup> (–3.13)	–6.10% <sup>b</sup> (–2.27)	–2.98% (–1.37)	–5.20% <sup>b</sup> (–2.01)	–0.90% (–0.24)	–2.36% (–1.01)	–6.08% <sup>a</sup> (–2.72)	–6.02% <sup>c</sup> (–1.87)	3.66% (0.92)
	2 Years	–5.81% <sup>a</sup> (–2.55)	–10.81% <sup>a</sup> (–2.80)	–2.95% (–0.81)	–3.10% (–0.74)	–7.71% (–1.36)	–6.94% <sup>c</sup> (–1.66)	–3.77% (–1.26)	–8.41% <sup>c</sup> (–1.75)	1.47% (0.23)
	3 Years	–3.12% (–0.99)	–8.44% <sup>c</sup> (–1.65)	1.37% (0.28)	–2.87% (–0.43)	–5.57% (–0.66)	–1.61% (–0.28)	–2.13% (–0.52)	–9.83% (–1.58)	8.23% (0.97)
All Stock	1 Year	–11.41% <sup>a</sup> (–5.04)	–17.49% <sup>a</sup> (–5.74)	–4.52% (–1.07)	–2.21% (–0.48)	–15.28% <sup>a</sup> (–2.76)	–4.31% (–1.24)	–18.89% <sup>a</sup> (–5.92)	–3.50% (–0.57)	–0.80% (–0.11)
	2 Years	–18.48% <sup>a</sup> (–6.33)	–23.16% <sup>a</sup> (–6.64)	–12.42% <sup>b</sup> (–2.03)	–13.84% <sup>c</sup> (–1.84)	–9.32% (–1.12)	–9.60% <sup>c</sup> (–1.75)	–26.41% <sup>a</sup> (–9.22)	–21.03% <sup>b</sup> (–2.32)	11.40% (1.08)
	3 Years	–26.14% <sup>a</sup> (–7.97)	–29.16% <sup>a</sup> (–7.75)	–26.15% <sup>a</sup> (–4.15)	–12.70% (–1.05)	–16.40% (–1.30)	–20.16% <sup>a</sup> (–3.14)	–29.84% <sup>a</sup> (–9.85)	–39.60% <sup>a</sup> (–3.48)	19.50% (1.49)

(continued)

**Table 4.10**—*Continued*

		Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )			
		High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
Mixed	1 Year	-6.36% <sup>a</sup> (-4.08)	-11.32% <sup>a</sup> (-6.01)	7.58% <sup>a</sup> (2.71)	-15.07% <sup>a</sup> (-4.22)	-10.15% <sup>a</sup> (-5.19)	-5.78% <sup>b</sup> (-2.30)	0.80% (0.36)	-10.95% <sup>a</sup> (-3.67)
	2 Years	-10.35% <sup>a</sup> (-5.15)	-21.20% <sup>a</sup> (-7.32)	10.52% <sup>b</sup> (2.10)	-19.81% <sup>a</sup> (-3.35)	-24.55% <sup>a</sup> (-7.67)	0.17% (0.05)	0.56% (0.15)	-25.11% <sup>a</sup> (-5.13)
	3 Years	-11.70% <sup>a</sup> (-4.45)	-21.49% <sup>a</sup> (-5.10)	10.27% (1.53)	-22.28% <sup>a</sup> (-2.88)	-29.07% <sup>a</sup> (-6.76)	-0.08% (-0.02)	1.53% (0.29)	-30.59% <sup>a</sup> (-4.45)
Panel C: Transaction Value									
Large	1 Year	-7.20% <sup>a</sup> (-4.54)	-5.88% <sup>a</sup> (-2.57)	1.41% (0.52)	-12.02% <sup>a</sup> (-3.18)	-7.24% <sup>a</sup> (-3.01)	-9.34% <sup>a</sup> (-3.74)	-1.03% (-0.41)	-6.20% <sup>c</sup> (-1.78)
	2 Years	-12.26% <sup>a</sup> (-5.99)	-11.87% <sup>a</sup> (-3.68)	-2.71% (-0.61)	-11.78% <sup>b</sup> (-2.18)	-17.90% <sup>a</sup> (-4.73)	-9.34% <sup>a</sup> (-3.55)	-2.27% (-0.56)	-15.64% <sup>a</sup> (-2.82)
	3 Years	-15.31% <sup>a</sup> (-6.19)	-13.66% <sup>a</sup> (-3.15)	-4.44% (-0.69)	-14.22% <sup>b</sup> (-1.96)	-27.46% <sup>a</sup> (-6.27)	-10.38% <sup>a</sup> (-3.26)	-0.75% (-0.13)	-26.72% <sup>a</sup> (-3.68)
Medium	1 Year	-6.60% <sup>a</sup> (-5.22)	-6.16% <sup>a</sup> (-3.17)	1.17% (0.42)	-12.17% <sup>a</sup> (-3.51)	-4.46% <sup>b</sup> (-2.25)	-9.66% <sup>a</sup> (-4.76)	-2.11% (-0.80)	-2.34% (-0.71)
	2 Years	-7.99% <sup>a</sup> (-4.13)	-7.58% <sup>b</sup> (-2.31)	2.33% (0.52)	-15.68% <sup>a</sup> (-2.96)	-8.97% <sup>b</sup> (-2.54)	-8.52% <sup>a</sup> (-3.49)	-5.66% (-1.38)	-3.30% (-0.61)
	3 Years	-10.61% <sup>a</sup> (-4.17)	-9.99% <sup>b</sup> (-2.27)	0.49% (0.07)	-16.66% <sup>b</sup> (-2.22)	-11.25% <sup>b</sup> (-2.34)	-8.93% <sup>a</sup> (-2.80)	-7.83% (-1.38)	-3.42% (-0.46)
Small	1 Year	-4.02% <sup>b</sup> (-2.50)	-2.16% (-0.83)	1.48% (0.54)	-9.05% <sup>b</sup> (-2.33)	-3.73% (-1.50)	-5.86% <sup>b</sup> (-2.11)	-1.56% (-0.49)	-2.17% (-0.54)
	2 Years	-8.28% <sup>a</sup> (-3.47)	-11.44% <sup>a</sup> (-3.25)	4.76% (0.83)	-16.20% <sup>b</sup> (-2.41)	-14.59% <sup>a</sup> (-3.58)	-3.96% (-1.17)	-1.14% (-0.23)	-13.46% <sup>b</sup> (-2.08)
	3 Years	-9.10% <sup>a</sup> (-3.01)	-12.65% <sup>a</sup> (-2.68)	4.99% (0.68)	-18.17% <sup>b</sup> (-2.12)	-16.83% <sup>a</sup> (-3.28)	-3.99% (-1.00)	-4.44% (-0.62)	-12.39% (-1.41)

stock payment, which subsequently leads to the long-term negative performance of acquiring firms.

As indicated in Panel B, the differences in BHAR between high- and low-liquidity portfolios are largely negative for acquisitions with stock or mixed payments. For instance, in a three-year period, high-liquidity stock offers substantially underperform against low-liquidity acquirers with stock payment by  $-16.40\%$ , while high-liquidity mixed offers significantly underperform against low-liquidity mixed offers by  $-24.97\%$ . However, for acquisitions with pure cash payments, the differences are much smaller, although they do, admittedly, remain negative. These results are related to previous findings relating to pre-announcement CARs. In general, stock payment acquisitions have stronger a correlation with aggregate liquidity in both pre-merger and post-merger periods.

Panel C of Table 4.10 shows the results for acquisitions classified by the level of transaction value. Acquirers' long-term BHAR are significantly negative across large, medium, and small transaction groups. Moreover, by comparing performance of high- and low-liquidity mergers, all mergers announced in high-liquidity markets have statistically significant negative BHAR, while low-liquidity acquirers have returns close to zero. Although the differences in BHAR between high- and low-liquidity acquisitions are negative, the results are larger and more statistically significant for portfolios constructed by aggregate liquidity demand.

To sum up, the post-merger performance of acquiring firms measured by BHAR generates significant results indicating that aggregate liquidity strongly affects acquiring firms' long-term performance. In general, mergers announced in high-liquidity markets deliver a worse performance than those announced in low-liquidity markets. These major results remain robust, even after controlling for various deal characteristics. Mergers with stock payments are found to have a stronger correlation with aggregate liquidity than cash offers. Moreover, the results of high-low BHAR differentials stand in sharp contrast to the differences in stock market reaction before and

around the announcement of mergers. Thus, high-liquidity acquisitions outperform (underperform) low-liquidity acquisitions in pre-announcement (post-acquisition) periods.

### ***B Calendar-Time Portfolio Regression (CTPR)***

In this section, I apply the calendar-time portfolio regression (CTPR) approach to measure the long-term performance of acquisitions. This methodology is strongly suggested by Fama and French (1993) and Mitchell and Stafford (2000). Instead of using the traditional ordinary least square (OLS) regression, I apply the weighted least square (WLS) regression, which weights the results in each calendar month with the number of securities in that month. When using OLS regression, event months with heavily weighted securities are treated the same as others, which reduces the importance of ‘hot’ periods of merger activity. The time-series of portfolio returns, net of the risk-free returns over the sample period, is regressed on the three Fama and French (1993) factors:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_pSMB_t + h_pHML_t + \epsilon_t \quad (4.5)$$

where  $R_{pt}$  is the equally-weighted return of the event portfolio,  $R_{ft}$  is the risk-free rate,  $(R_{mt} - R_{ft})$  represents excess return on the market,  $SMB$  is the difference between a portfolio of ‘small’ and ‘big’ stocks, and  $HML$  is the difference between a portfolio of ‘high’ and ‘low’ book-to-market stocks. Within this framework, the intercept  $\alpha_p$  measures the average monthly abnormal return on the portfolio of acquiring firms.

Table 4.11 shows the results of calendar-time regression for acquisitions throughout the entire sample and various liquidity portfolios. Calendar-time returns are calculated for 12, 24, and 36 months of post-merger periods. Panel A and Panel B of Table 4.11 show the calendar-time regression results of aggregate liquidity de-

**Table 4.11: Calendar-Time Three-Factor WLS Regression**

This table presents the results of three-factor calendar-time portfolio regression (CTPR) approach with weighted least square (WLS) regressions. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. Merger deals announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Panel A (Panel B) shows the results of liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolios based on  $Debt/GDP$ ). Each monthly abnormal return is calculated using a time-series regression, where the dependent variables is the equally weighted portfolio return in each calendar month of all bidders within each subgroup that completed an acquisition in the previous 12, 24, or 36 months. The independent variables are the Fama-French (1993) factors, where the regression equation is:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_pSMB_t + h_pHML_t\epsilon_t.$$

where  $R_{pt}$  is the event portfolio return,  $R_{ft}$  is the risk-free rate,  $(R_{mt} - R_{ft})$  represents excess return on the market,  $SMB$  is the difference between a portfolio of “small” and “big” stocks,  $HML$  is the difference between a portfolio of “high” and “low” book-to-market stocks. The intercept of the time-series regression is the monthly abnormal return (in percentage).  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	High (30%)	Medium (40%)	Low (30%)	All
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>				
1 Year	-0.596% <sup>c</sup> (-1.80)	-0.404% <sup>a</sup> (-2.75)	-0.339% <sup>b</sup> (-2.07)	-0.630% <sup>a</sup> (-3.56)
2 Years	-0.393% <sup>c</sup> (-1.37)	-0.387% <sup>a</sup> (-2.71)	-0.228% <sup>c</sup> (-1.77)	-0.476% <sup>a</sup> (-2.71)
3 Years	-0.016% <sup>c</sup> (-0.06)	-0.226% <sup>c</sup> (-1.73)	-0.137% <sup>c</sup> (-1.18)	-0.225% <sup>c</sup> (-1.36)
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>				
1 Year	-0.609% <sup>a</sup> (-3.52)	-0.101% <sup>c</sup> (-0.33)	-0.001% <sup>c</sup> (0.00)	-0.630% <sup>a</sup> (-3.56)
2 Years	-0.569% <sup>a</sup> (-2.99)	0.299% <sup>c</sup> (1.10)	-0.004% <sup>c</sup> (-0.03)	-0.476% <sup>a</sup> (-2.71)
3 Years	-0.342% <sup>c</sup> (-1.75)	0.422% <sup>c</sup> (1.69)	0.037% <sup>c</sup> (0.33)	-0.225% <sup>c</sup> (-1.36)

mand ( $\Delta C/S$ ) and aggregate liquidity supply ( $Debt/GDP$ ) constructed portfolios. As shown in Panel A, for 12 months after the completion of an acquisition, low-liquidity mergers have a significant return of  $-0.596\%$  per month, which corresponds to  $-7.152\%$  over one year. Conversely, the abnormal return for low-liquidity acquisitions is only  $-0.339\%$  per month. For 12-month and 24-month periods, I find that mergers announced in low-liquidity periods outperform corresponding high-liquidity acquisitions. Panel B shows that high-liquidity acquirers have statistically significant negative returns over three years after the completion of mergers, while low-liquidity acquirers have calendar-time returns indifferent from zero.

In summary, the abnormal results measured by CTPR support the negative correlation between aggregate liquidity and long-term post-merger acquisition performance, although the magnitude of abnormal returns is quite different from BHAR.<sup>18</sup> The differences in calendar-time returns between high- and low-liquidity acquisitions are significant for the two-year post-merger period, while the three-year performance differences are statistically insignificant.

### 4.5.3 Multivariate Regression Analysis

In this section, I run multivariate regressions to control for various factors that may affect the abnormal performance of acquisitions. Many previous studies have demonstrated that acquisition performance can be explained by a number of market or firm factors. Rau and Vermaelen (1998) show that an acquirer's own valuation (market-to-book) affects post-acquisition performance. Asquith, Bruner, and Mullins (1983) and Moeller, Schlingemann, and Stulz (2004) find that the size of an acquisition relative to the size of acquirer has an impact on the abnormal returns of the acquisition. Further, using multivariate regression analysis can avoid the small sample problems

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<sup>18</sup>It is notable that CTPR might reduce the power of abnormal returns by weighting each time period equally, and bias results toward market efficiency. Loughran and Ritter (2000) argue that there should be differences in abnormal return estimates across different methodologies.



that can arise in the univariate analysis, where the sample of mergers is split into many subgroups.

The dependent variables in the regression analysis are the forty-day pre-announcement CAR, the five-day announcement CAR and the two-year BHAR.<sup>19</sup> I estimate the following model:

$$\begin{aligned}
 AR = a_0 &+ a_1 HighLiqDummy + a_2 MediumLiqDummy + a_3 CashDummy \\
 &+ a_4 StockDummy + a_5 HighMBDummy + a_6 MediumMBDummy \\
 &+ a_7 LogRelSize + a_8 PreAnnReturn
 \end{aligned} \tag{4.6}$$

where  $AR$  is the forty-day CAR, five-day CAR and two-year BHAR. *HighLiqDummy* (*MediumLiqDummy*) equal to one if the acquisition was announced in a high-liquidity (medium-liquidity) market and zero otherwise. *CashDummy* (*StockDummy*) equals one if the total transaction value of acquisition was paid in cash (stock) and zero otherwise. *HighMBDummy* (*MediumMBDummy*) equals one if the acquirer belongs to the high (medium) M/B category and zero otherwise. *LogRelSize* is defined as the logarithm of the transaction value at the time of the acquisition announcement, divided by the acquirer's market value of equity one month prior to the announcement date. As explained earlier, these factors are included to control for their affects on acquisitions. *PreAnnReturn* is the cumulative pre-announcement stock return (measured from 150 days until 31 days prior to the announcement date). Since pre-announcement run-ups could affect both announcement results and long-run post-merger results, *PreAnnReturn* is used to ensure that my findings do not capture short-term stock price persistence, as in Jegadeesh and Titman (1993).

Table 4.12 shows the multivariate regression results, which confirm the previous findings from the univariate analysis. It is clear that the pre-announcement forty-day returns of low M/B, mixed payment acquisitions that are announced in a low-liquidity

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<sup>19</sup>The results are similar when using abnormal returns in different event periods.

**Table 4.12: Regression Analysis of Short-Run and Long-Run Returns**

This table presents ordinary least squares regressions of the acquirer's forty-day pre-announcement CAR, five-day CAR, and two-year BHAR on the following variables. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. *HighLiqDummy* (*MediumLiqDummy*) equals one if the acquisition was announced in a high-liquidity (medium-liquidity) market and zero otherwise. *CashDummy* (*StockDummy*) equals one if the total transaction value of acquisition was paid in cash (stock) and zero otherwise. Acquirers are divided into subsamples of high (30%), medium (40%), and low (30%) M/B firms based on their market-to-book ratio one month prior to the acquisition announcement. *HighMBDDummy* (*MediumMBDDummy*) equals one if the acquirer belongs to the high (medium) firm-valuation category and zero otherwise. *LogRelSize* is the log of the transaction value at the time of the acquisition announcement divided by the acquirer's market value of equity one month prior to the announcement. *PreAnnReturn* is the firm's cumulative abnormal stock return measured over  $[-150, -31]$ . In all subpanels, the intercept represents a low M/B, mixed payment merger and was announced in a low-liquidity merger market. *t*-statistics are provided in parenthesis. Superscripts *a*, *b*, and *c* indicate significant at the 1, 5, and 10 percent levels, respectively.

	Liquidity Demand ( $\Delta L/S$ )			Liquidity Supply ( $Debt/GDP$ )		
	Dependent Variable= (-40, -1) CAR	Dependent Variable= (-2, +2) CAR	Dependent Variable= Two-Year BHAR	Dependent Variable= (-40, -1) CAR	Dependent Variable= (-2, +2) CAR	Dependent Variable= Two-Year BHAR
<i>Intercept</i>	-3.08% <sup>a</sup> (-3.80)	-0.28% (-0.50)	-8.66% <sup>b</sup> (-2.43)	-2.45% <sup>a</sup> (-2.95)	-0.32% (-0.55)	-12.68% <sup>a</sup> (-3.54)
<i>HighLiqDummy</i>	2.64% <sup>a</sup> (3.24)	0.44% (0.78)	-12.47% <sup>a</sup> (-3.59)	1.04% (1.19)	1.28% <sup>b</sup> (2.12)	-10.19% <sup>a</sup> (-2.76)
<i>MediumLiqDummy</i>	1.98% <sup>b</sup> (2.41)	0.90% (1.59)	-10.99% <sup>a</sup> (-3.14)	2.24% <sup>b</sup> (2.55)	0.13% (0.22)	-4.29% (-1.15)
<i>CashDummy</i>	-0.20% (-0.28)	-0.19% (-0.38)	-1.91% (-0.64)	-0.37% (-0.53)	-0.16% (-0.32)	-1.57% (-0.52)
<i>StockDummy</i>	3.47% <sup>a</sup> (4.80)	-3.45% <sup>a</sup> (-6.90)	-15.46% <sup>a</sup> (-4.96)	3.46% <sup>a</sup> (4.77)	-3.53% <sup>a</sup> (-7.05)	-15.24% <sup>a</sup> (-4.87)
<i>HighMBDDummy</i>	2.95% <sup>a</sup> (4.00)	2.28% <sup>a</sup> (4.48)	31.27% <sup>a</sup> (9.88)	2.79% <sup>a</sup> (3.76)	2.27% <sup>a</sup> (4.45)	31.62% <sup>a</sup> (9.92)
<i>MediumMBDDummy</i>	0.72% (1.06)	0.73% (1.55)	11.63% <sup>a</sup> (3.95)	0.73% (1.07)	0.67% (1.42)	12.25% <sup>a</sup> (4.15)
<i>LogRelSize</i>	0.41% <sup>a</sup> (5.29)	0.56% <sup>a</sup> (10.68)	1.15% (1.10)	0.40% <sup>a</sup> (5.24)	0.561% <sup>a</sup> (10.66)	1.36% (1.29)
<i>PreAnnReturn</i>	21.93% <sup>a</sup> (19.30)	0.87% (1.10)	-16.62% <sup>a</sup> (-3.33)	21.96% <sup>a</sup> (19.30)	1.058% (1.34)	-18.53% <sup>a</sup> (-3.70)
Adjusted <i>R</i> <sup>2</sup>	14.60%	4.60%	3.70%	14.50%	4.80%	3.60%

demand (supply) market are statistically significantly negative at  $-3.08\%$  ( $-2.45\%$ ). The coefficient on the high- and medium-liquidity dummy ( $\Delta L/S$ ) is positive and significant ( $2.64\%$  and  $1.98\%$ , respectively). Thus, as in the univariate analysis, acquisitions initiated in high-liquidity markets have significantly higher CARs. The abnormal returns are significantly higher if the merger is paid for in stock ( $3.47\%$ ), and when the acquirer's M/B ratio is high at the time of the acquisition announcement ( $2.95\%$ ).<sup>20</sup> Moreover, CARs are higher if the relative size is larger ( $0.41\%$ ), and are significantly higher if the acquirer experiences larger pre-announcement stock returns ( $21.93\%$ ). When using a five-day CAR around the announcement, the results are consistent with previous univariate tests. The coefficient on the liquidity dummies is insignificantly positive. While coefficients on other factors are similar to those for the forty-day CAR, the stock dummy is significant and negative ( $-3.45\%$ )

Table 4.12 also shows the regression results when the dependent variable is a two-year BHAR. The two-year BHAR of low M/B, mixed payment acquisitions that are announced in a low-liquidity demand (supply) market are statistically significantly negative at  $-8.66\%$  ( $-12.68\%$ ). BHARs are significantly lower if the acquisition is announced in a high-liquidity demand or supply market ( $-12.47\%$  and  $-10.19\%$ , respectively). Similar to the announcement CAR, the BHAR is significantly lower if it is paid for in stock ( $-15.46\%$ ) and higher if the acquirer has a higher M/B ratio ( $31.27\%$ ). Consistent with the long-run stock price reversal as in Jegadeesh and Titman (1993), BHARs are significantly negatively related to pre-announcement price run-ups ( $-16.62\%$ ).

In summary, the size and significance of these coefficients suggest that aggregate liquidity factors are an important determinant of both the short- and long-run performances of acquisitions, even after controlling for various factors. They affect the performance of acquirers over the method of payment used and acquirers' own valuations and stock price run-ups. The results from multivariate regression further

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<sup>20</sup>These findings are consistent with results in Rau and Vermaelen (1998).

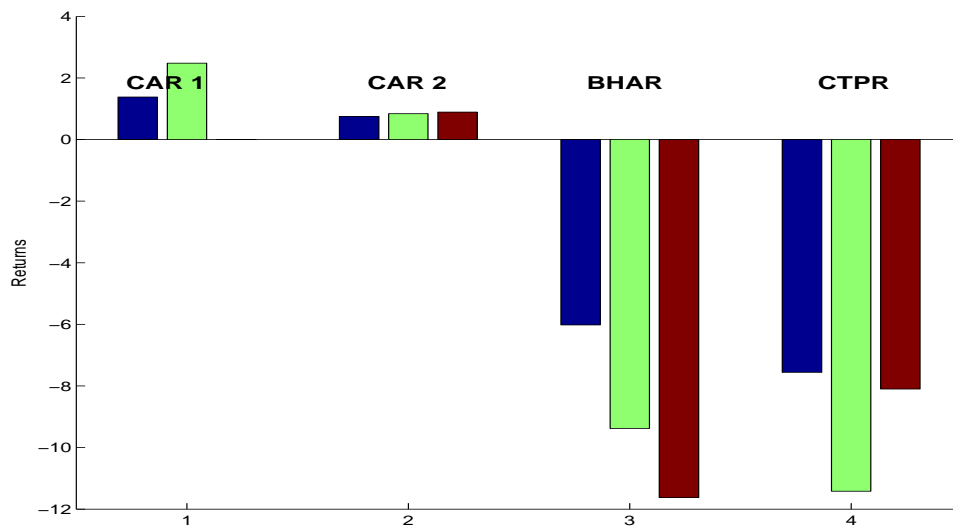
support previous findings on univariate analysis, and indicate that acquisitions initiated in low-liquidity markets have a better performance than those announced in high-liquidity markets.

#### 4.5.4 Summary

Figure 4.7 summarises the results of merger performance, which are consistent with most of the previous studies in the literature. Since my sample of mergers covers an extensive time period (from 1980 to 2003), these results deliver further support to previous evidence in the literature.

**Figure 4.7: Summary of Merger Performance**

This figure presents the summary of acquisition performance. The sample of mergers contains 4,162 completed U.S. domestic acquisitions between 1980 and 2003 listed on SDC, where the publicly traded acquiring firm is listed on the NYSE, AMEX, or Nasdaq, and gains control of a public, private, or subsidiary target firm whose transaction value is at least \$100 million. CAR 1 (CAR 2) is the pre-announcement (announcement) CAR.



The major finding in this section is that, when applying aggregate liquidity into the analysis, most of these abnormal performances are generated by high-liquidity acquisitions. While high-liquidity acquirers experience significantly higher announcement and pre-announcement returns (CAR) than low-liquidity acquisitions, their

long-term post-merger performances (BHAR and calendar-time return) are substantially lower. In contrast, acquisitions initiated in low-liquidity markets often have short-run and long-run returns indifferent from zero. These patterns are clearly demonstrated in univariate analysis, where the sample of mergers is split into various subgroups based on aggregate liquidity ( $\Delta L/S$  or  $Debt/GDP$ ) and deal characteristics. The differences in performance between high- and low-liquidity acquisitions are significantly positive for pre-announcement and announcement period CARs, but significantly negative for post-merger BHARs and CTPRs. The results of the multivariate regression analysis further demonstrate that, after controlling for various factors that may impact on the abnormal performance of acquirers, aggregate liquidity factors are positively correlated with pre-announcement CARs and negatively correlated with post-merger BHARs.

## 4.6 Conclusion

Motivated by prior theoretical and empirical research that suggests the importance of liquidity in corporate investment and financing activity, in this research I question whether mergers announced when aggregate liquidity is high are fundamentally different from those initiated during low aggregate liquidity periods. In particular, I examine whether the activity and performance of acquisitions are different in various liquidity markets. Previous studies seldom investigate the importance of the aggregate liquidity and its implications for corporate takeover activities. Considering that many predictors for stock market returns have been successfully applied to explain anomalies in M&A, I expect aggregate liquidity factors to have strong explanatory powers on merger activity and quality.

Through empirical investigation, I find evidence that aggregate liquidity substantially influences aggregate merger activity and the performance of acquiring firms. The results demonstrate that merger activity tends to be higher when aggregate liq-

uidity demand or supply is higher, while stock-financed acquisitions show stronger responses to the changing of aggregate liquidity than cash-financed acquisitions. The performance of acquiring firms in the announcement period is significantly better for acquisitions announced in high-liquidity markets relative to those announced in low-liquidity markets. However, this finding is reversed in long-term performance, where acquirers buying in high-liquidity markets significantly underperform relative to acquirers buying during low-liquidity markets in the three years after the acquisition. These results on acquisition performance are valid in a univariate analysis and multivariate regression setting. The correlations between aggregate liquidity and acquisition performance remain clear after controlling for various other factors that may affect acquirer performance including targets' public status, the method of payment, and the acquirer's own M/B ratio.

Overall, the results in this research strongly suggest that acquisitions undertaken during the period of low aggregate liquidity are better in quality. These findings are in line with previous explanations in Harford (1999) that cash-rich firms are more likely to undertake value-decreasing acquisitions. The aggregate liquidity factors measure the entire market's liquidity level. When there are more than sufficient liquidity flowing in the markets, firms can easily acquire "cheap" money to initiate irrational investment projects, most of which will decrease the benefits of shareholders. In the contrast, only firms with serious investment considerations and sufficient liquidity holdings are more like to initiate takeovers in low-liquidity markets; such acquisitions in low liquidity status can benefit these firms' performance in the long-term.

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## Chapter 5

# Equity Issue Puzzles and Aggregate Liquidity

### 5.1 Introduction

There is a considerable body of literature on public equity issuance including initial public offerings (IPOs) and seasoned equity offerings (SEOs). In academic research, several major empirical patterns for IPOs and SEOs have been documented. First, both the numbers of IPOs and SEOs and the total proceeds raised in these offerings vary substantially over time (e.g. Ibbotson and Jaffe (1975), Ibbotson, Sindelar, and Ritter (1988, 1994), and Lowry (2003)). Lowry (2003) argues that the variation of IPO volume is far in excess of the variation in capital expenditure by corporations, suggesting that other potential factors have a substantial effect on the time of a firm's IPO. Second, there is severe underpricing of IPOs (e.g. Smith (1986) and Ritter and Welch (2002)) and significant discounting of SEOs (e.g. Smith (1977) and Loderer, Sheehan, and Kadlec (1991)). The degree of underpricing (or discounting) changes over time, and has a positive correlation with equity offering volume. Third, a substantial amount of research has documented that equity issuers suffer post-issue long-run stock underperformance over a one- to five-year horizon (e.g. Ritter (1991),



Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995)).

These *equity issue puzzles* attract a large amount of attention in the academic literature. A number of theoretical and empirical studies investigate the cause and effect of corporate financing decisions, and explore potential explanations for abnormal phenomena. For instance, Lowry (2003) investigates the determinants of IPO waves, Baker and Wurgler (2000) explore the importance of time series patterns in SEOs, Loughran and Ritter (2004) examine three hypotheses for the change in IPO underpricing, and Brav, Geczy, and Gompers (2000), Eckbo, Masulis, and Norli (2000), and Lyandres, Sun, and Zhang (2008) investigate whether other factors can explain the long-run underperformance of offering firms.

While fully recognising the achievements of prior research in providing explanations for puzzles on equity issues, my primary objective in this chapter is to explore whether aggregate liquidity factors can explain the observed abnormal phenomena in association with IPOs and SEOs. In particular, this research will empirically address the following questions: Can aggregate liquidity factors explain equity issue waves? Are IPOs and SEOs occurring in high aggregate liquidity markets fundamentally different from those that occur in low aggregate liquidity markets?

Liquidity is an important and special asset for firms operating in imperfect capital markets (see, e.g., Kim, Mauer, and Sherman (1998) and Opler, Pinkowika, Stulz, and Williamson (1999)). Despite the importance of corporate liquidity reserves and market liquidity supply to companies in practice, and to theories in corporate finance, limited attention has been given to exploring the influence of liquidity on corporate external financing activity and quality. Moreover, no previous research has investigated the effects of aggregate liquidity on public equity issuance, or examined whether the quality and performance of IPOs and SEOs are related to aggregate liquidity factors. Considering liquidity factors at aggregate level allow us to investigate the existence of IPO and SEO anomalies and the influence of aggregate liquidity

on corporate external financing.<sup>1</sup>

In this research, I use a sample of 5,529 IPOs and a sample of 6,100 SEOs announced between January 1, 1972 and December 31, 2004 to investigate the correlation between aggregate liquidity and equity offerings. The sample size and period are among the largest in the literature. I examine whether fundamental differences exist in the quality and performance of issuances between IPOs and SEOs made under high aggregate liquidity markets and those occurring in low aggregate liquidity periods. The factors of aggregate liquidity include aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS). In order to measure the aggregate corporate liquidity demand, by following the methodology in Greenwood (2005), I use data reported in the Federal Reserve's *Flow of Funds* to construct a measure of the aggregate corporate accumulation of liquid asset as a fraction of total corporate investment spending. To construct the aggregate market liquidity supply measure, I apply the U.S. *Debt/GDP* ratio by following Krishnamurthy and Vissing-Jorgensen (2008).

Based on time-series aggregate liquidity factors, I partition the sample periods of IPOs and SEOs into times of high-, medium-, and low aggregate liquidity periods (30%, 40%, 30%) based on the prior year's aggregate liquidity. Then IPOs and SEOs announced under different aggregate liquidity periods are put into high-, medium-, and low-liquidity portfolios, respectively. In this research, I investigate the explanations of aggregate liquidity on the three major patterns of IPOs and SEOs, namely waves of equity offerings, the existing and changing of underpricing and the long-run underperformance of issuing firms. In order to capture these patterns and their correlations with aggregate liquidity, I calculate IPO underpricing, SEO discounting, first-month returns, and long-run buy-and-hold abnormal returns.

The main findings of this research suggest that aggregate liquidity measures are

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<sup>1</sup>Brav, Geczy, and Gompers (2000) and Eckbo, Masulis, and Norli (2000) study the existence of equity issuance anomalies.

strongly related to the activity and performance of equity issuances. Firstly, IPOs (SEOs) activity, measured by the number and proceeds of IPOs (SEOs), are positively correlated with aggregate liquidity factors including liquidity demand ( $\Delta L/S$ ) and supply ( $Debt/GDP$ ). Secondly, changes to IPO and SEO underpricing can be explained by aggregate liquidity. I apply three proxies for underpricing. The underpricing of IPOs and SEOs in the whole sample is driven by that of equity offerings occurring in high aggregate liquidity markets. The differences of underpricing between high- and low-liquidity portfolios are highly positive and statistically significant. Finally, consistent with the results for short-term underpricing, the long-run underperformance of issuing firms only exists for IPOs and SEOs in high aggregate liquidity periods. The positive correlation between aggregate liquidity and the degree of negative BHAR is clearly presented by the negative differences of BHAR between high- and low-liquidity portfolios.

This research contributes to the literature in the following two ways. First, it establishes the importance of aggregate liquidity in explaining the activity of equity offerings and, more importantly, the performance of issuing firms. The potential influence of liquidity on IPOs and SEOs has been limited in its documentation. Lowry (2003) propose and examine the capital demands hypothesis, which suggests that fluctuations in IPO volume are driven by changes in private firms' aggregate demand for capital (cash). He concludes that IPO volume is positively related to companies' demands for capital. DeAngelo, DeAngelo, and Stulz (2007) argue that the fundamental need for cash to resolve a near-term liquidity squeeze is the primary motivation for selling stock, instead of market timing.

Second, this research complements current findings in the literature that refer to the "window of opportunity". The observed clustering of equity issues is consistent with the widely held belief that certain periods offer a "window of opportunity" for raising funds in capital markets (see Choe, Masulis, and Nanda (1993), Bayless and Chaplinsky (1996), and Helwege and Liang (2004)). Prior research in this stream usu-

ally classifies the period of time with macroeconomic criteria, the aggregate volume of equity issues and even market valuations. This research adds to current findings by using aggregate liquidity to identify Hot markets and Cold markets. Even though empirical evidence strongly suggests that there are fundamental differences in the IPOs and SEOs between equity offering periods identified by aggregate liquidity, I cannot rule out market timing as a secondary influence that systematically impacts on IPO and SEO decisions.

The rest of this chapter is organised as follows. Section 5.2 discusses the sample selection and the empirical methodology used in the empirical analysis. Section 5.3 presents the empirical results for IPO firms and Section 5.4 presents the empirical results for SEO firms. Finally, Section 5.5 concludes this chapter and summarises empirical findings.

## **5.2 Sample Selection and Descriptive Statistics**

In this section, I describe the criteria for the IPO sample (in Section 5.2.1) and the SEO sample (in Section 5.2.2). Section 5.2.3 introduces the empirical strategy that links aggregate liquidity to IPOs and SEOs, and the rationales for choosing such an empirical methodology.

### **5.2.1 IPO Sample**

The sample of initial public offerings (IPOs) is collected from the Thomson One Banker New Issues Database for the period of 1972 to 2004.<sup>2</sup> The New Issues Database in Thomson One Banker is exactly the same as the Securities Data Corporation (SDC) New Issues Database, which is the commonly-used data source for studies in IPOs and SEOs. Both Thomson One Banker and SDC are maintained

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<sup>2</sup>Thomson One Banker is derived from the well-known Thomson Financial sources, including SDC Platinum, I/B/E/S, Worldscope and many more.

by the Thomson Financial Services.<sup>3</sup> In the following discussion, the source of data is referred to as ‘SDC’ for simplicity. For the IPO sample, daily stock prices and monthly returns for IPO firms are extracted from the Center for Research in Security Prices (CRSP). Accounting information is collected from the COMPUSTAT Annual Industrial Files. Since SDC does not report the CRSP PERMNO for equity offering firms, I search for PERMNO by matching on CUSIP. The data items obtained from SDC include the issue date, the offer price, the proceeds amount, the amount of shares offered, and the CUSIP of the offering firms.

By following some previous studies, IPOs have to satisfy the following criteria to be included in the IPO sample:

1. Equity offering must be performed by a U.S. firm listed in the CRSP database.
2. IPOs should issue ordinary common stocks and not be a unit offering, which represents a combination of securities such as common stocks and warrants.
3. Equity offerings must include at least some primary shares (following Brav, Geczy, and Gompers (2000)). Both pure primary share offerings and a combination of primary and secondary share offerings are included.
4. The equity offering of firms that trade on exchanges other than the American Stock Exchange (AMEX), New York Stock Exchange (NYSE), and Nasdaq are excluded.
5. Issues by closed-end funds, unit investment trusts, real estate investment trusts (REITs), and American Depositary Receipts (ADRs) are excluded.
6. Issues by utility firms (SIC codes 4910 through to 4949) are excluded from the sample (following Loughran and Ritter (1995)).<sup>4</sup>

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<sup>3</sup>Discussion with Thomson One Banker employee verified that both databases are the same.

<sup>4</sup>Utility offerings tend to be different from those of other operating companies.

**Table 5.1: Number, Gross Proceeds, Underpricing, First-month Returns, and Amount of Money Left on the Table of Initial Public Offerings (IPOs) by Year, 1972 to 2004**

This table presents the distribution of IPOs across years. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. Gross proceeds is the amount raised from investors in millions (2004 purchasing power using the CPI, local market offering amount, excluding overallotment options). The equal-weighted (EW) mean IPO underpricing is measured as the percent price change between the first CRSP-listed closing price and the offer price, relative to the offer price. The EW mean first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the first-day closing prices.

Year	Number of IPOs	Number of IPOs in NYSE / AMEX	Average Gross Proceeds (\$ millions)	Mean IPO Underpricing	Mean First-month Return	Average Money Left on the Table (\$ millions)
1972	20	9	41.92	4.12%	-3.39%	2.19
1973	20	13	23.67	3.63%	-10.68%	2.56
1974	4	3	20.37	0.79%	-19.62%	0.26
1975	2	2	39.94	11.69%	27.56%	3.35
1976	12	9	35.85	4.07%	-2.88%	1.25
1977	11	4	18.87	13.99%	17.42%	1.65
1978	18	6	30.14	16.10%	12.93%	4.72
1979	29	13	18.58	10.77%	11.79%	2.34
1980	52	18	28.63	33.02%	40.06%	7.45
1981	114	33	24.76	11.76%	17.29%	1.87
1982	53	4	29.46	14.31%	23.04%	5.28
1983	311	62	48.32	10.99%	14.18%	4.40
1984	124	20	25.74	4.50%	4.05%	0.80
1985	147	26	44.49	7.86%	14.14%	2.86
1986	321	57	56.22	8.80%	10.46%	3.49
1987	223	53	43.44	7.90%	5.02%	2.96
1988	86	19	40.55	6.91%	7.74%	1.64
1989	79	18	43.35	7.88%	8.46%	2.54
1990	94	15	35.45	11.72%	12.12%	3.40
1991	237	39	53.71	12.34%	18.78%	6.39
1992	334	62	61.14	11.15%	12.90%	5.36
1993	417	59	64.02	12.86%	16.20%	7.97
1994	315	47	44.02	9.83%	12.77%	4.46
1995	364	43	58.25	21.12%	28.69%	11.70
1996	538	70	53.88	16.43%	21.42%	9.67
1997	358	66	61.42	14.44%	16.50%	9.69
1998	239	51	59.97	22.89%	26.82%	12.47
1999	391	29	109.13	75.45%	106.14%	73.96
2000	301	17	145.06	58.26%	68.08%	70.27
2001	58	18	259.60	15.57%	10.63%	39.86
2002	54	17	139.02	8.01%	4.72%	12.94
2003	52	14	131.41	14.40%	16.96%	18.13
2004	151	37	113.01	11.46%	15.03%	15.14
Total	5,529	953	65.98	19.89%	25.29%	15.51

The initial sample of IPOs generated from the SDC with these criteria consists of 5,711 IPOs from 1972 to 2004. Among them, 18 IPO firms without matched PERMNO and 20 IPO firms with replicated CUSIP are excluded from the IPO sample. Although SDC data extends back to 1970, the sample of IPO starts in 1972 because the data coverage in SDC before 1972 appears to be less comprehensive. In addition, Nasdaq did not start until 1971 and the CRSP Nasdaq tape did not start until late 1972. Yung, Çolak, and Wang (2008) apply the starting point of 1973 under similar considerations when using an SDC database. The reason for ending the IPO sample in 2004 is to have at least three years' post-issue stock returns for equity offering firms from CRSP. Although SDC provides a comprehensive coverage of IPO data, its equity offer date is not an accurate indicator of the actual offer day. To overcome this problem and the potential mismatching of firms' PERMNO codes in CRSP, I follow the procedure in Helwege and Liang (2004). If a firm is matched on CRSP, I require that the first trading date is no more than 10 days after the IPO date from SDC; or if it appeared before the IPO date, then with non-missing trading prices no more than two days before the IPO date. This requirement further reduces the IPO sample by 144 deals. Nearly half of these rejected deals (71 firms) are taken out because of the limited CRSP coverage of Nasdaq stocks in 1972.

Thus, the final sample of IPOs contains 5,529 firms after the screening process, resulting in one of the largest samples in the literature. For comparison, Loughran and Ritter's (1995) sample contains 4,753 IPOs and Brav, Geczy, and Gompers's (2000) sample includes 4,622 IPOs. Table 5.1 reports the annual breakdown of the IPO sample. Column 2 in the table shows the number of IPOs that occurred in each sample year. It is clear that the volume of IPOs changes substantially through time, and the IPO market experienced a large boom in the 1990s, which contains 3,494 equity offerings in between 1991 and 2000. Column 3 of Table 5.1 shows the number of IPOs listed on the NYSE and AMEX, where only 953 IPOs are listed in these two exchanges. In the U.S., most firms went public on the Nasdaq market. The

number of IPOs in NYSE/AMEX varies widely and is particularly low during the period 1974–1978. Panel A of Figure 5.1 presents the annual number of firms that went public from 1972 to 2004, separated by listing exchanges (i.e. NYSE/AMEX or Nasdaq). It is obvious that most IPOs went public on the Nasdaq, and that the IPO market has two booms over the sample period.

Table 5.1 also reports the average gross proceeds raised from IPOs, mean IPO underpricing, mean first-month return, and average amount of money left on the table. Gross proceeds is the amount of capital in millions raised from investors in U.S. local markets. Gross proceeds exclude over-allotment options and are adjusted into 2004 purchasing power using the Consumer Price Index (CPI). Similar to the number of IPOs, the IPO activity measured by annual gross proceeds is modest in the 1980s (about \$38 million per year). In the 1990s, the issuing volume roughly doubled to \$60 million per year during 1990–1999, and then tripled to \$202 million per year during 2000–2001, before falling to \$139 million in 2002.

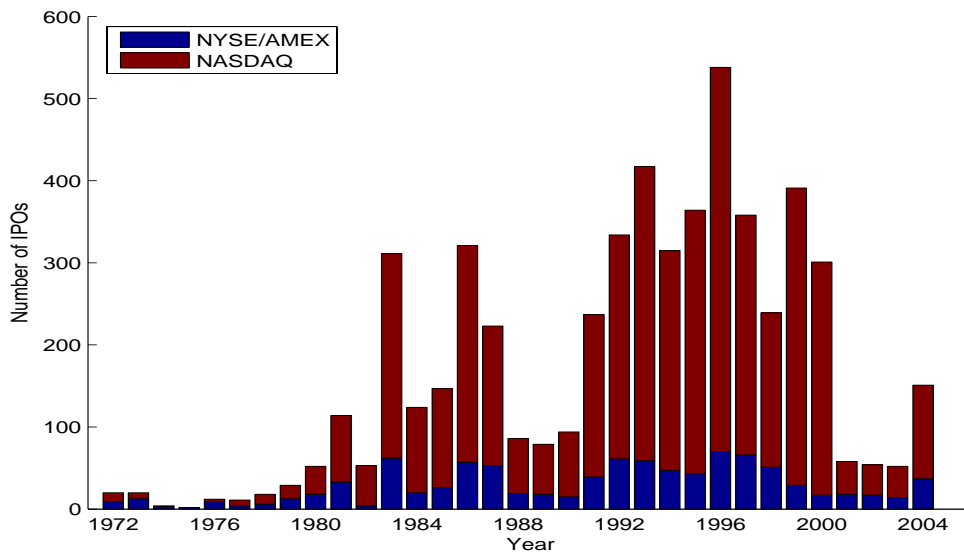
IPO underpricing (or IPO first-day return), denoted by  $U = (P_1 - P_0)/P_0$ , is defined as the percentage price change between the CRSP-listed first trading day closing price ( $P_1$ ) and the offer price ( $P_0$ ), relative to the offer price. The IPO first-month return, denoted by  $R_m = (P_{21} - P_0)/P_0$ , is measured as the percentage price change between the twenty-first trading day closing price ( $P_{21}$ ) and the offer price, relative to the offer price. The mean underpricing for the whole IPO sample is about 20% and the mean first-month return is 25.3%, which is slightly larger than the first-day return. This evidence shows that the degree of IPO underpricing is mostly reflected by the market price at end of the first trading day. Average IPO underpricing for each year within the sample period ranges from 0.79% in 1974 to 75.45% in 1999. The IPO sample also has the largest and smallest mean first-month returns in these two years (−19.62% and 106.14%, respectively). Table 5.1 indicates that the time series pattern of the average first-day returns in the IPO sample is very similar to that shown in Ritter and Welch (2002). For example, the average first-day



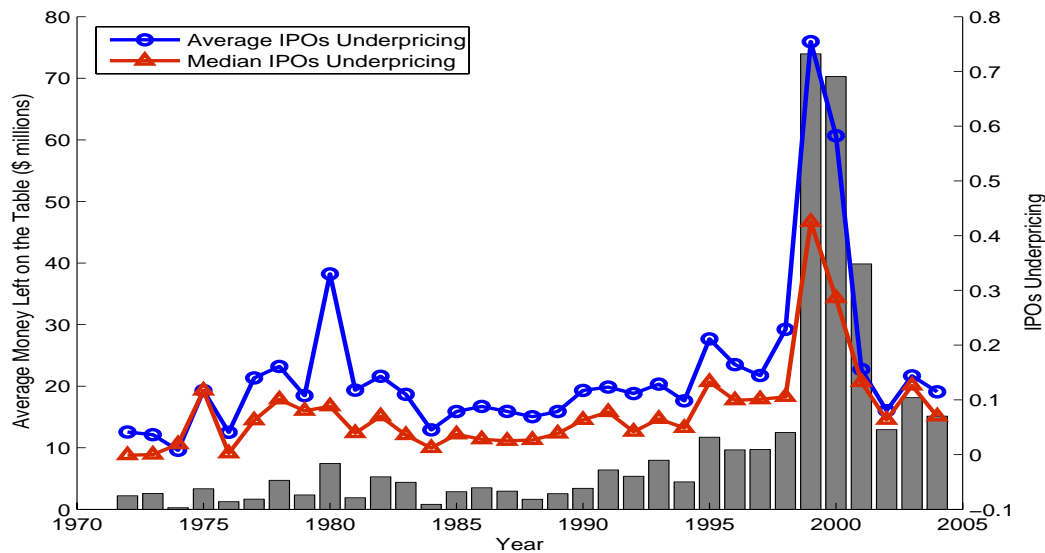
**Figure 5.1: Number, Underpricing, Money Left on the Table of IPOs**

This figure presents the annual number (in Panel A), underpricing, and money left on the table (in Panel B) of IPOs. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. The IPO underpricing is measured as the percent price change between the first CRSP-listed closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the first-day closing prices.

**Panel A: Number of IPOs**



**Panel B: IPO Underpricing and Money Left on the Table**



returns are 11.0% in 1983, 11.7% in 1990, 21.1% in 1995, and 75.5% in 2000. The corresponding underpricing for these four years are 10.1%, 10.8%, 21.5%, and 71.7%, respectively, in Ritter and Welch (2002).

The last column in Table 5.1 shows the amount of money left on the table, which is calculated as the number of shares issued multiplied by the change from the offer price to the first trading day closing price and adjusted into 2004 purchasing power using CPI. Similar to IPO underpricing and first-month return, the annual value of money left on the table changes substantially from year to year. Panel B of Figure 5.1 shows the performance of mean and median IPO underpricing and the amount of money left on the table. The time series patterns of all three series are similar, and the average IPO underpricing is larger than median underpricing for most of the time. The differences reached their peak in 1999 when the amount of money left on the table was at its largest.

Table 5.2 presents the distribution of IPO sample classified by 15 industry groups. I follow the industry classification in Lowry (2003). IPOs in the sample are separated based on the SIC codes of firms going public, which are shown in Table 1 in Lowry (2003). The distribution of IPOs is similar to that shown in Lowry (2003), where the communications, computer, and electronics industries have the largest amount of IPOs (1,751). More than 1,200 firms in the finance and trade industries went public between 1972 and 2004. Table 5.2 also shows the average gross proceeds and mean underpricing of IPOs in each industry. The food industry has the largest mean gross proceeds of \$132 million, while the communications industry has the highest first-day return of 34.9%.

### **5.2.2 SEO Sample**

The sample of seasoned equity offerings (SEOs) is collected from the Thomson One Banker New Issues Database over the period of 1972 to 2004. Similar to the IPO

**Table 5.2: Sample of IPOs and SEOs classified by Industry**

This table presents descriptive statistics for the IPO sample and SEO sample classified by 15 industry groups. The sample of IPOs (SEOs) consists of 5,529 IPOs (6,100 SEOs) by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. Percent of sample is the percent of the number of equity offerings in each industry to the total number of IPOs or SEOs in the sample. Gross proceeds is the amount raised from investors in millions (2004 purchasing power using the CPI, local market offering amount, excluding over-allotment options). The equal-weighted (EW) mean IPO underpricing is measured as the percent price change between the first CRSP-listed closing price and the offer price, relative to the offer price. The EW mean SEO discounting is measured as the percent price change between prior day's closing price and the offer price, relative to the offer price.

Industry	Initial Public Offerings (IPOs)				Seasoned Equity Offerings (SEOs)			
	Number of IPOs	Percent of Sample	Average Gross Proceeds (\$ millions)	Mean IPO Underpricing	Number of SEOs	Percent of Sample	Average Gross Proceeds (\$ millions)	Mean SEO Discounting
Agriculture, Mining	32	0.59%	96.94	1.58%	68	1.13%	111.26	2.18%
Apparel	80	1.47%	65.81	6.83%	78	1.30%	57.26	3.55%
Communication, Computer, Electronics	1,751	32.10%	66.73	34.95%	1,469	24.46%	133.51	3.97%
Construction	55	1.01%	57.73	7.57%	60	1.00%	56.95	2.94%
Finance	632	11.59%	94.55	8.79%	842	14.02%	118.13	5.38%
Food	63	1.16%	132.09	12.41%	55	0.92%	91.33	1.84%
Healthcare	504	9.24%	47.84	10.69%	672	11.19%	78.11	5.86%
Manufacturing	408	7.48%	60.59	8.29%	598	9.96%	111.41	3.97%
Oil, Gas	111	2.04%	99.87	9.19%	339	5.65%	131.26	4.30%
Printing, Publishing	40	0.73%	92.29	10.40%	34	0.57%	48.90	3.37%
Recreation	112	2.05%	69.81	16.95%	139	2.31%	137.22	4.55%
Scientific Instruments and Research	478	8.76%	48.16	17.68%	464	7.73%	65.92	4.11%
Services	343	6.29%	63.96	25.67%	240	4.00%	95.83	5.24%
Trade	634	11.62%	51.64	14.24%	657	10.94%	76.75	2.63%
Transportation	211	3.87%	72.30	10.86%	290	4.83%	120.05	2.10%

sample, data on stock returns and accounting information is collected from CRSP and COMPUSTAT, respectively. Again, all offering firms are matched with a PERMNO code by using CUSIP from SDC. To be included in the sample of SEOs, firms issuing seasoned equity have to satisfy the following criteria:

1. Equity offering must be performed by a U.S. firm which has been listed on the CRSP database.
2. SEOs should issue ordinary common stocks and not be a unit offering, which represents a combination of securities, such as common stocks and warrants.
3. Equity offerings must include at least some primary shares (following Corwin (2003)). Both pure primary share offerings and combination of primary and secondary share offerings are included.
4. Equity offering of firms that trade on exchanges other than the American Stock Exchange (AMEX), New York Stock Exchange (NYSE), and Nasdaq are excluded.
5. Issues by closed-end funds, unit investment trusts, real estate investment trusts (REITs), and American Depositary Receipts (ADRs) are excluded.
6. Issues by utility firms (SIC codes 4910 through to 4949) are excluded from the sample (following Loughran and Ritter (1995)).

The initial SEO sample generated from SDC includes 6,454 SEOs from 1972 to 2004. Fifteen SEO deals without matched PERMNO in CRSP are excluded. Based on reasons similar to those used for the IPO sample, I choose 1972 and 2004 as the starting and ending points of my SEO sample, respectively. By following Corwin (2003), I require offering firms to have at least 30 days' prior trading data available on CRSP, which further excludes 339 offerings. The purpose of such restrictions is

**Table 5.3: Number, Gross Proceeds, Discounting, First-month Returns, and Amount of Money Left on the Table of Seasoned Equity Offerings (SEOs) by Year, 1972 to 2004**

This table presents the distribution of SEOs across years. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. Gross proceeds is the amount raised from investors in millions (2004 purchasing power using the CPI, local market offering amount, excluding overallotment options). The equal-weighted (EW) mean SEO discounting is measured as the percent price change between prior day's closing price and the offer price, relative to the offer price. The EW mean first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the prior day's closing price.

Year	Number of IPOs	Number of SEOs in NYSE / AMEX	Average Gross Proceeds (\$ millions)	Mean SEO Discounting	Mean First-month Return	Average Money Left on the Table (\$ millions)
1972	43	40	109.41	4.41%	6.34%	1.46
1973	22	18	141.26	3.15%	-4.33%	2.93
1974	14	12	110.70	2.27%	-1.66%	4.27
1975	36	34	212.70	1.42%	4.78%	2.78
1976	55	48	168.05	-0.07%	-0.34%	0.31
1977	23	16	171.05	2.43%	2.93%	-0.05
1978	63	45	49.89	1.54%	2.40%	0.44
1979	54	42	58.58	1.03%	3.40%	0.42
1980	157	114	64.58	3.62%	4.34%	2.32
1981	138	87	81.53	3.21%	2.77%	1.85
1982	128	87	84.95	0.70%	7.61%	0.07
1983	407	241	62.79	1.85%	6.07%	1.17
1984	85	48	53.11	0.94%	2.28%	0.17
1985	208	87	74.42	3.17%	6.33%	1.57
1986	286	115	78.94	2.42%	4.98%	1.15
1987	172	97	95.28	9.71%	3.57%	6.91
1988	61	29	77.40	1.67%	6.49%	0.88
1989	120	44	59.93	1.58%	4.49%	0.55
1990	96	49	84.90	2.02%	1.33%	0.80
1991	296	125	91.70	3.48%	9.93%	3.36
1992	264	119	95.28	4.01%	6.08%	2.23
1993	369	132	80.94	5.04%	5.89%	3.60
1994	211	71	81.13	6.86%	6.15%	4.54
1995	347	77	82.36	4.42%	7.73%	2.35
1996	424	113	92.67	5.22%	7.54%	3.30
1997	355	92	104.98	5.04%	5.83%	3.02
1998	235	83	132.22	3.70%	7.80%	4.01
1999	281	70	188.08	5.02%	8.72%	10.80
2000	283	48	241.98	6.21%	3.11%	13.94
2001	200	70	152.16	5.18%	5.60%	5.26
2002	183	83	132.13	3.69%	7.45%	5.45
2003	238	89	131.64	5.92%	13.31%	7.45
2004	246	93	131.63	5.45%	4.47%	4.75
Total	6,100	2,518	106.31	4.17%	6.18%	3.87

to reduce potential mismatching in CUSIP-to-PERMNO and to make sure the SEO sample only contains follow-on equity offerings.

The final sample of SEOs contains 6,100 follow-on public equity offerings once the aforementioned criteria have been satisfied. Data coverage for the SEO sample is one of the largest in the literature. For comparison, the samples in Loughran and Ritter (1995), Eckbo, Masulis, and Norli (2000), and Brav, Geczy, and Gompers (2000) consist of 3,702, 4,766, and 4,526 SEOs, respectively. Table 5.3 reports the annual breakdown of the SEO sample. Similar to IPOs, the number of SEOs varies greatly within the sample period. Panel A of Figure 5.2 graphs the annual number of SEOs listed on the NYSE/AMEX or Nasdaq. By comparing this with Panel A of Figure 5.1, it is clear that the annual numbers of IPOs and SEOs are correlated, and most transactions happened in the 1990s. However, different from IPOs, almost half of the SEOs (2,518) in the sample were carried out by firms listed on the NYSE and AMEX. Table 5.2 also reports the distribution of an SEO sample classified by fifteen industry groups. The distribution of the SEO sample is very similar to that of the IPO sample, where the communication industry has the largest amount of SEO deals (1,469).

The annual mean gross proceeds raised from SEOs, mean SEO discounting, mean first-month return, and the average amount of money left on the table are shown in column 4 to column 7 in Table 5.3. The gross proceeds from the SEOs also exclude overallotment options and are adjusted into 2004 purchasing power using CPI. The average gross proceeds for the sample of SEOs is \$106.3 million, which is smaller than that of the IPO sample (\$66 million). The calculation for SEO discounting and money left on the table is different from that used for IPOs. SEO discounting, denoted by  $D = (P_{-1} - P_0)/P_0$ , is defined as the percentage price change between the prior offer day's closing price ( $P_{-1}$ ) and the offer price ( $P_0$ ), relative to the offer price. By following Mola and Loughran (2004), the SEO money left on the table is measured as the dollar discount ( $P_{-1} - P_0$ ) multiplied by the number of shares in the

offering, expressed in millions of constant 2004 dollars. Although IPO underpricing and SEO discounting are both measured as close-to-offer returns, the closing price for IPO underpricing and SEO discounting is the first available closing price ( $P_1$ ) and the prior day's closing price ( $P_{-1}$ ), respectively.<sup>5</sup>

For the sample of SEOs, the mean SEO discounting is 4.17%, the mean first-month return is 6.18% and the average amount of money left on the table is \$3.87 million. The corresponding values of these variables are 19.89%, 25.29%, and \$15.51 million for the IPO sample, which are about four times larger than those for the SEOs. Panel B of Figure 5.2 depicts SEO discounting (both mean and median) and SEO money left on the table. SEO discounting trends upward during the sample period. Similarly, the average amount of money left on the table also increases through time.

Although the time series variations of SEO discounting and IPO underpricing are quite similar, there are certainly more outliers in the results of the SEO sample, as the differences between the mean and median SEO discounting are abnormally large in certain years (e.g. 1972, 1987, and 1994). For instance, the equally-weighted mean discounting is 9.71% in 1987 and 6.86% in 1994, while the corresponding median discounting is only 0.54% and 2.59%. Such huge differences might be caused by data errors. Indeed, as recognised in some studies on SEO discounting or underpricing, the offer date of follow-on equity offerings provided by SDC is not an accurate indicator of the actual offer-day. If the offer date is incorrect, then the measured SEO discounting and money left on the table cannot fully reflect the really values, as the prior day's closing price is incorrect as well.

Lease, Masulis, and Page (1991) note that SDC-stated offer dates for SEOs are often inappropriate for analysing price effects because some offers take place after the close of trading. They find that 25% of offers from 1981 to 1983 took place

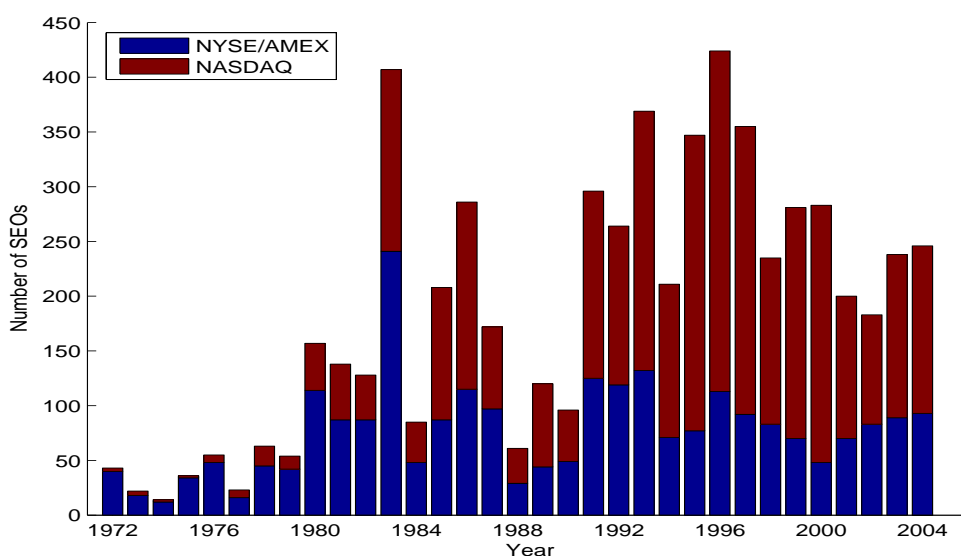
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<sup>5</sup>SEO underpricing has been widely studied in the literature. Table 1 in Altinkılıç and Hansen (2003) provides a summary of studies on SEO underpricing and discounting. The percentages of underpricing and discounting are similar and economically and statistically significant.

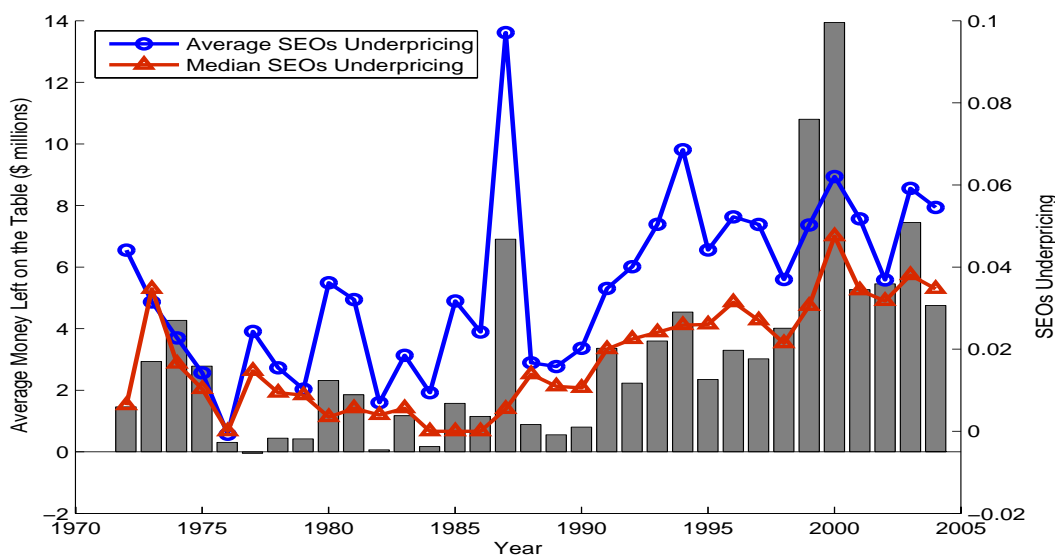
**Figure 5.2: Number, Discounting, Money Left on the Table of SEOs**

This figure presents the annual number (in Panel A), discounting, and money left on the table (in Panel B) of SEOs. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. The SEO discounting is measured as the percent price change between prior day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the prior day's closing price.

**Panel A: Number of SEOs**



**Panel B: SEO Discounting and Money Left on the Table**





after the close of business. Safieddine and Wilhelm (1996) suggest a volume-based correction method that exploits the enormous trading volume surge on the offer-day. In particular, if trading volume on the day following the SDC-stated offer date is more than twice the trading volume on the SDC offer date, or more than twice the average daily volume over the previous 250 trading days, then the day following the SDC offer date is designated as the offer date. Some recent papers follow Safieddine and Wilhelm (1996) to correct the offer date provided by SDC. Altinkılıç and Hansen (2003) find that over 50% of the offer dates stated in SDC are incorrect. Corwin (2003) finds that a volume-based correction method results in an offer date change for 35.1% of the sample offers. Such a large amount of incorrectly stated offer dates in SDC will certainly affect the results of SEO discounting. This also partially explains the large differences between mean and median SEO discounting in certain years. Although the potentially incorrect SDC-stated offer date might affect following analyses associated with aggregate liquidity, I have not applied such method to correct SEO offer dates. This is because I have applied both the mean and median values of SEO discounting into the analysis. The median SEO discounting of the sample should be less likely to be affected, even though there might be some unusual large or small returns due to an incorrect offer date.

### 5.2.3 Empirical Design

The purpose of this chapter is to examine potential aggregate liquidity-based explanations for “abnormal” phenomena in the market of public equity offerings. Specifically, I want to examine whether public equity offerings (i.e. IPOs and SEOs) initiated in high-liquidity markets are significantly different from those carried out in low-liquidity markets. In order to achieve this aim, I apply the aggregate corporate liquidity demand (ACLD),  $\Delta L/S$ , and aggregate market liquidity supply (AMLS),  $Debt/GDP$ . Firstly, the IPO (SEO) market in a particular year ( $t$ ) is classified

as a high-liquidity (30%), medium-liquidity (40%), or low-liquidity (30%) market based on the aggregate liquidity measures in the prior year ( $t - 1$ ). Since the samples of IPOs and SEOs both cover the same period from 1972 to 2004, I construct time series of aggregate liquidity measures for 1971–2003.<sup>6</sup> Therefore, the whole sample period (24 years) of IPOs and SEOs is partitioned into 10 high-liquidity, 13 medium-liquidity, and 10 low-liquidity years (equity offering markets). Under this classification, there are two sets of high-, medium-, and low-liquidity IPO (or SEO) markets, based on ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ), respectively.<sup>7</sup> Secondly, initial (seasoned) equity offerings announced in high-, medium-, and low-liquidity markets are classified as high-, medium-, and low-liquidity IPOs (SEOs), and placed into corresponding liquidity portfolios.

To sum up, I separate the samples of IPOs and SEOs by using the aggregate liquidity in the prior year of equity offerings. Since there are two samples of equity issuance and two measures of aggregate liquidity, such classifications create four sets of high-, medium-, and low-liquidity portfolios including IPO liquidity demand portfolios, IPO liquidity supply portfolios, SEO liquidity demand portfolios, and SEO liquidity supply portfolios.

In this research, I use aggregate liquidity to identify different equity offering markets, based on the expectation that the aggregate liquidity plays an important role in explain “puzzling” phenomena related to IPOs (SEOs). In the literature relating to IPOs and SEOs, many studies also apply this empirical classification method to examine the influences of market conditions on equity offerings. Started by Ibbot-

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<sup>6</sup>I have performed statistic and correlation analysis for both aggregate liquidity measures. The statistic results, which have not been tabulated here, are similar to those discussed in Section 3.2 due to a similar sample period.

<sup>7</sup>For ACLD ( $\Delta L/S$ ), high-liquidity markets include the years: 2000, 2004, 2001, 1977, 1976, 1984, 1972, 1990, 1999, 1997; medium-liquidity markets include the years: 1993, 2002, 1983, 1974, 1986, 1992, 1973, 1996, 1985, 1987, 1994, 1998, 1980; and low-liquidity markets include the years: 1995, 1979, 2003, 1981, 1978, 1988, 1975, 1982, 1989, 1991. For AMLS ( $Debt/GDP$ ), high-liquidity markets include the years: 1994, 1995, 1996, 1997, 1993, 1998, 1992, 1999, 1991, 1989; medium-liquidity markets include the years: 1990, 1988, 2000, 1987, 1986, 2004, 2001, 1985, 2003, 2002, 1984, 1983, 1977; and low-liquidity markets include the years: 1972, 1978, 1973, 1979, 1981, 1974, 1982, 1980, 1976, 1975.

son and Jaffe (1975), many papers now investigate the phenomenon of “hot” issue markets, which are commonly defined as periods of IPO or SEO markets that have unusually high volume and/or large initial returns. Ritter (1984) defines hot IPO markets as periods of high initial returns. Based on National Bureau of Economic Research (NBER) business cycle data, Choe, Masulis, and Nanda (1993) classify periods of expansionary phases and contractionary phases of the business cycle using the dates of cycle peaks and troughs, and examine the security issuance activity across these periods.

The following studies often define “hot” IPO or SEO markets based on volume. For hot IPO markets, Loughran and Ritter (1995) describe the 1980s as hot compared to the 1970s. Helwege and Liang (2004) define hot (cold) months as periods with at least three consecutive months that have a moving average IPO count scaled by business formations of more than 30 (less than 10.5) IPOs. Yung, Çolak, and Wang (2008) define IPO quarters as hot (cold) periods if the moving average of IPOs is 50% above (below) the historical average. For hot SEO markets, Bayless and Chaplinsky (1996) apply the aggregate volume of equity issues to identify periods of hot and cold markets. They argue that a price reaction to equity issue announcements in hot periods (high equity issue volume) is lower on average than in cold periods (low equity issue volume).

The mentioned studies and this research share the similarity that, instead of separating the IPO (or SEO) sample cross-sectionally, the sample period of IPOs (or SEOs) is partitioned based on certain market conditions through time. Therefore, the classification method applied in this research, dividing issuance years into high-, medium-, or low-liquidity markets based on aggregate liquidity in the year prior to offerings, is almost the same as those methods used in studies on hot IPO (or SEO) markets. The major difference is that I apply aggregate liquidity measures to classify IPO and SEO markets instead of using volume or the underpricing of equity issues. Although most of these studies classify hot or cold market periods quarterly, I can

only separate markets on an annual basis due to the limitation of aggregate liquidity data. Moreover, since accounting and economic data, like ACLD and AMLS, is not instantly observable to corporations, I apply the prior year's aggregate liquidity measures to classify IPO and SEO markets.

## **5.3 Empirical Results for IPO firms**

In this section, the correlation between aggregate liquidity and public equity issues is examined with the sample of IPOs.

### **5.3.1 Volume and Proceeds of IPOs**

Compared to the vast literature on IPOs, the variation of IPO volume has received relatively less attention. Ibbotson and Jaffe (1975) and Ibbotson, Sindelar, and Ritter (1988, 1994) show substantial fluctuations in IPO volume and identify significant autocorrelation of the monthly number of IPOs. However, these studies do not examine the underlying cause of this variation. Pagano, Panetta, and Zingales (1998) systematically test the relative power of several potential determinants of IPOs. They find that companies are more likely to have IPOs when average market-to-book ratio of public firms in their industry is higher. They interpret their finding as an indication that companies time their IPOs to take advantage of industry-wide overvaluations. Lowry (2003) explores three potential explanations for the variation in IPO volume. He finds that firms' demands for capital and investor sentiment are important determinants of IPO volume, in both statistical and economic terms.

Table 5.4 presents the volume of IPOs, measured by number and gross proceeds, within different aggregate liquidity portfolios. Considering the number of IPOs, there are 1,520 initial offerings in the period of high aggregate corporate liquidity demand. However, this number drops to 1,034 for low liquidity IPOs. The positive correlation between aggregate liquidity and the number of issues is even strong for

**Table 5.4: IPO Activity versus Aggregate Liquidity**

This table presents the number of IPOs and gross proceeds within different aggregate liquidity portfolios for the IPO sample. Panel A (Panel B) reports the results for liquidity demand (supply) portfolios. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years  $(t)$  are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Gross proceeds is the amount raised from investors in millions (2004 purchasing power using the CPI, local market offering amount, excluding overallotment options). Statistical significance on mean and median values are based on  $t$ -tests and Wilcoxon tests, respectively.  $p$ -values are reported in brackets. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

		High (30%)	Medium (40%)	Low (30%)	Differences	
	All				H-L	$p$ -value
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>						
Number of IPOs	5,529	1,520	2,975	1,034	486	
Gross Proceeds (\$ millions)						
Mean	65.98	97.66	54.84	51.47	46.19 <sup>a</sup>	[0.000]
Median	37.03	51.77	31.47	32.84	18.93 <sup>a</sup>	[0.000]
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>						
Number of IPOs	5,529	3,272	1,933	324	2,948	
Gross Proceeds (\$ millions)						
Mean	65.98	63.06	77.42	27.34	35.72 <sup>a</sup>	[0.000]
Median	37.03	39.29	35.06	17.67	21.62 <sup>a</sup>	[0.000]

AMLS ( $Debt/GDP$ ). The difference in the IPO number between high- and low-liquidity markets is 2,948, which is larger than 486 for ACLD ( $\Delta L/S$ ).

Table 5.4 also shows the distribution of IPO volume by measuring the gross proceeds in various aggregate liquidity portfolios. Gross proceeds are the amount raised from investors in millions, which have been adjusted for inflation by CPI. The empirical evidence for gross proceeds is the same as for the number of IPOs. For aggregate liquidity demand ( $\Delta L/S$ ), the mean (median) value difference between high- and low-liquidity IPOs is 46.19 (18.93) and statistically significant. The corresponding differences are 35.72 and 21.62 for portfolios constructed by aggregate liquidity supply ( $Debt/GDP$ ).

Thus, the results show that aggregate liquidity and IPO activity are positively correlated, and IPO volume increases in both aggregate liquidity factors. These results share some similarity with those found in Lowry (2003), where IPO volume is positively related to companies' demand for capital. Although Lowry (2003) uses different proxies for firms' capital demands in his research, both studies reveal the importance of liquidity (capital) in corporate financing activity.

To further explore whether this positive correlation is driven by other factors, I classify the sample of IPOs by exchange listing and gross proceeds. Subsamples of IPOs consist of offering firms listed on the Nasdaq or NYSE/AMEX. In addition, the sample of IPOs is partitioned into subsamples with large (30%), medium (40%), and small (30%) gross proceeds levels. Panel A of Table 5.5 shows the frequency distribution of IPOs across aggregate liquidity portfolios ( $\Delta L/S$  or  $Debt/GDP$ ) and offering characteristics. The left sub-panel presents the frequency distribution created by the intersection between aggregate liquidity demand and exchange listing (i.e. Nasdaq or NYSE/AMEX) or gross proceeds value (i.e. large (30%), medium(40%), or small (30%)).

The Nasdaq is the main place to be for firms wishing to go public,<sup>8</sup>, with over

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<sup>8</sup>See, for example, Loughran (1993).

**Table 5.5: Frequency Distribution of IPOs and SEOs across Aggregate Liquidity and Offering Characteristics**

This table presents the frequency distribution across aggregate liquidity portfolios and offering characteristics for the sample of IPOs (in Panel A) and the sample of SEOs (in Panel B). The sample of IPOs (SEOs) consists of 5,529 IPOs (6,100 SEOs) by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. Equity issues (both IPOs and SEOs) announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years  $(t)$  are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. The frequency distribution is defined as the ratio (in percentage) of the number of observations in a given subgroup divided by the total number of observations (5,529 for IPO sample, 6,100 for SEO sample). In each panel, the left subpanel presents the frequency distribution created by intersection of aggregate liquidity demand portfolios ( $\Delta L/S$ ) with exchange listing (i.e. Nasdaq or NYSE/AMEX) or gross proceeds (i.e. large (30%), medium (40%), small (30%)). The right subpanel presents the frequency distribution created by intersection of aggregate liquidity supply portfolios ( $Debt/GDP$ ) with exchange listing or gross proceeds.

<b>Panel A: Initial Public Offerings (IPOs)</b>							
<i>Exchange Listing</i>	All	Liquidity Demand ( $\Delta L/S$ )			Liquidity Supply ( $Debt/GDP$ )		
		High	Med	Low	High	Med	Low
All	100.00	27.49	53.81	18.70	59.18	34.96	5.86
Nasdaq	82.76	23.44	44.08	15.25	50.43	28.47	3.87
NYSE/AMEX	17.24	4.05	9.73	3.45	8.75	6.49	1.99
<i>Gross Proceeds</i>	All	High	Med	Low	High	Med	Low
All	100.00	27.49	53.81	18.70	59.18	34.96	5.86
Large (30%)	30.02	12.43	13.02	4.58	17.87	11.61	0.54
Medium (40%)	39.99	10.63	21.58	7.78	27.42	11.00	1.57
Small (30%)	29.99	4.43	19.21	6.35	13.89	12.35	3.74
<b>Panel B: Seasoned Equity Offerings (SEOs)</b>							
<i>Exchange Listing</i>	All	Liquidity Demand ( $\Delta L/S$ )			Liquidity Supply ( $Debt/GDP$ )		
		High	Med	Low	High	Med	Low
All	100.00	27.33	48.39	24.28	47.57	40.79	11.64
Nasdaq	58.72	17.92	27.33	13.48	32.39	23.33	3.00
NYSE/AMEX	41.28	9.41	21.07	10.80	15.18	17.46	8.64
<i>Gross Proceeds</i>	All	High	Med	Low	High	Med	Low
All	100.00	27.33	48.39	24.28	47.57	40.79	11.64
Large (30%)	30.03	11.89	12.18	5.97	13.82	13.57	2.64
Medium (40%)	39.98	10.34	19.49	10.15	21.05	14.61	4.33
Small (30%)	29.98	5.10	16.72	8.16	12.70	12.61	4.67





82% of the offerings undertaken in the Nasdaq market in my sample of IPOs. The percentage of IPOs (number of IPOs) is higher when aggregate liquidity is high, regardless of exchange listing. However, the positive correlation between aggregate liquidity and the number of IPOs is much stronger for the Nasdaq listing. For liquidity supply portfolios, which are shown in the right sub-panel, the differences in between high- and low-liquidity IPOs are also larger for the Nasdaq listing. Considering the high variations in volume of IPOs in the Nasdaq market, which are shown in Panel A of Figure 5.1, it is reasonable to observe larger differences for the Nasdaq listing IPOs.

Panel A of Table 5.5 also reports the frequency distribution across aggregate liquidity and gross proceeds. Overall, the positive correlation between aggregate liquidity and the number of offerings remains significant throughout the high-, medium-, and low-proceeds groups. Note that only 4.58% (0.54%) of IPOs are located in the high-proceed group when the liquidity demand (supply) condition is low. These results suggest the important influence of aggregate liquidity on the proceed amounts in IPOs.

Panel A of Table 5.6 shows the proceeds value of IPOs classified by aggregate liquidity, exchange listing, and proceed levels. Even though most of the issuing firms went public via Nasdaq, the scale of IPOs is much larger for those listed on NYSE/AMEX. The differences in gross proceeds between high- and low-liquidity IPOs are positive and statistically significant for all subsamples. For instance, high minus low is \$164.20 million for liquidity demand portfolios and \$129.30 million for liquidity supply portfolios, where both values are significant at the 1% level.

Overall, I have found a strong positive correlation between aggregate liquidity and IPO activity, measured in the number of IPOs and IPO gross proceeds. This correlation is unaffected by exchange listing and the amount of proceeds. The findings here for the IPO sample are closely related to the documented positive correlation between firms' capital demand and IPO volume in Lowry (2003).

### 5.3.2 Underpricing of IPOs

The best-known pattern in the IPO literature is the widely-recognised IPO underpricing, which reflects the price change measured from the offering price to the market closing price on the first trading day. Early research based on data from the 1970s and 1980s shows that the shares offered in IPOs tend to be underpriced (e.g. Logue (1973), Ibbotson (1975), and Smith (1986)). Ljungqvist (2006) and Ritter and Welch (2002) provide thorough reviews on IPO underpricing. In this section, I test whether aggregate liquidity influences the performance of IPOs in the short-run, which is reflected by underpricing proxies.

Motivated by a number of studies on underpricing, I apply three proxies for IPO underpricing: IPO underpricing, first-month return, and money left on the table. The IPO underpricing (or IPO first-day return), denoted by  $U = (P_1 - P_0)/P_0$ , is defined as the percentage price change between the CRSP-listed first trading day closing price ( $P_1$ ) and the offer price ( $P_0$ ), relative to the offer price. In general, it is widely recognised that the full extent of underpricing can be realised by the end of the first day of trading in the capital market without restrictions on daily price volatility. This is why the first-day return is used as a measure of underpricing. However, it is also very likely that the degree of underpricing cannot be fully reflected in the markets by the end of the first trading day. Therefore, I calculate the first-month return, which is measured as the percentage price change between the twenty-first trading day's closing price and the offer price, relative to the offer price. The money left on the table is calculated as the number of shares issued multiplied by the change from the offer price to the first trading day closing price and adjusted in 2004 purchasing power with CPI. This proxy represents the underpricing in an absolute amount of money.

Table 5.7 presents the underpricing of IPOs, first-month returns, and the amount of money left on the table within different aggregate liquidity portfolios for the

**Table 5.7: Underpricing of IPOs versus Aggregate Liquidity**

This table presents the underpricing of IPOs, first-month returns, and amount of money left on the table within different aggregate liquidity portfolios for the IPO sample. Panel A (Panel B) reports the results for liquidity demand (supply) portfolios. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left subpanel reports the mean value and the right subpanel reports the median value. The IPO underpricing is measured as the percent price change between the first CRSP-listed closing price and the offer price, relative to the offer price. The first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the first-day closing prices. Statistical significance on mean and median values are based on  $t$ -tests and Wilcoxon tests, respectively.  $t$ -statistics are reported in parentheses.  $p$ -values are reported in brackets. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

	Mean					Median				
	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>										
Underpricing	19.89% <sup>a</sup> (34.26)	37.36% <sup>a</sup> (20.99)	12.73% <sup>a</sup> (27.52)	14.80% <sup>a</sup> (22.81)	22.56% <sup>a</sup> (11.91)	7.14% <sup>a</sup> [0.000]	12.50% <sup>a</sup> [0.000]	5.15% <sup>a</sup> [0.000]	8.21% <sup>a</sup> [0.000]	4.29% <sup>a</sup> [0.000]
First-Month Return	25.29% <sup>a</sup> (31.35)	48.13% <sup>a</sup> (19.55)	15.47% <sup>a</sup> (23.76)	20.25% <sup>a</sup> (19.28)	27.88% <sup>a</sup> (10.42)	10.71% <sup>a</sup> [0.000]	18.32% <sup>a</sup> [0.000]	7.81% <sup>a</sup> [0.000]	12.50% <sup>a</sup> [0.000]	5.82% <sup>a</sup> [0.000]
Money Left on the Table (\$ millions)	15.51	38.57	6.52	7.46	31.12 <sup>a</sup> (11.27)	1.90	5.57	1.29	2.03	3.54 <sup>a</sup> [0.000]
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>										
Underpricing	19.89% <sup>a</sup> (34.26)	22.13% <sup>a</sup> (27.51)	17.03% <sup>a</sup> (18.94)	14.35% <sup>a</sup> (8.28)	7.78% <sup>a</sup> (4.07)	7.14% <sup>a</sup> [0.000]	9.17% <sup>a</sup> [0.000]	4.46% <sup>a</sup> [0.000]	5.40% <sup>a</sup> [0.000]	3.77% <sup>a</sup> [0.000]
First-Month Return	25.29% <sup>a</sup> (31.35)	29.35% <sup>a</sup> (26.29)	19.65% <sup>a</sup> (15.88)	17.68% <sup>a</sup> (7.05)	11.67% <sup>a</sup> (4.25)	10.71% <sup>a</sup> [0.000]	12.90% <sup>a</sup> [0.000]	7.27% <sup>a</sup> [0.000]	5.00% <sup>a</sup> [0.000]	7.90% <sup>a</sup> [0.000]
Money Left on the Table (\$ millions)	15.51	16.22	16.32	3.56	12.66 <sup>a</sup> (11.50)	1.90	2.89	1.09	0.74	2.15 <sup>a</sup> [0.000]

sample of IPOs. Both the mean and median values for the whole sample and each aggregate liquidity portfolio are reported. The mean IPO underpricing is 19.89% and the median IPO underpricing is 7.14% for all IPOs. Such large underpricing is consistent with the widely documented pattern in the literature that denotes severe IPO underpricing. Ritter and Welch (2002) document an average first-day return of 18.8% for their sample of IPOs in the period from 1980 to 2001. In contrast to the situation where the full extent of underpricing is realised by the end of the first trading day, I find that the mean (median) first-month return for the IPO sample is 25.29% (10.71%), larger than the corresponding first-day returns. This evidence suggests that the degree of IPO underpricing in the offer price is not fully reflected in the first-trading day; the market gradually adjusts the underpriced stock through time.

The positive correlations between aggregate liquidity factors and the three proxies for IPO underpricing are obvious. For portfolios separated based on liquidity demand, the underpricing of high-liquidity IPOs is significantly larger than for those of medium- and low-liquidity IPOs. The difference in first-day returns between high- and low-liquidity IPOs is 22.56% and significant at the 1% level. Measured in the absolute amount of money, IPOs announced in high-liquidity markets, on average, leave about \$31 million more on the table than IPOs initiated in low-liquidity markets. For the entire IPO sample, because the median values of underpricing proxies are smaller than the corresponding mean values, the differences in median underpricing are relatively smaller in magnitude as well. However, all three differences are statistically significantly positive. Panel B of Table 5.7 shows the results of underpricing proxies for all IPOs and IPOs announced in various liquidity supply (*Debt/GDP*) markets. The results suggest a positive correlation between aggregate liquidity supply and the underpricing of IPOs, where all the differences are positive and statistically significant at the 1% level.

Table 5.8 presents the underpricing of IPOs (in Panel A), first-month returns (in

**Table 5.8: Underpricing of IPOs across Aggregate Liquidity and Offering Characteristics**

This table presents the underpricing of IPOs (in Panel A), first-month returns (in Panel B), and amount of money left on the table (in Panel C) within different aggregate liquidity portfolios, which is further classified by exchange listing (i.e. NASDAQ or NYSE/AMEX) or gross proceeds (i.e. large (30%), medium (40%), small (30%)). The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left subpanel reports the results for liquidity demand portfolios based on  $\Delta L/Sources$  and the right subpanel reports the results for liquidity supply portfolios based on  $Debt/GDP$ . The IPO underpricing is measured as the percent price change between the first CRSP-listed closing price and the offer price, relative to the offer price. The first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the first-day closing prices. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

	Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )					
	High (30%)	Medium (40%)	Low (30%)	Differences	High (30%)	Medium (40%)	Low (30%)	Differences		
				H-L <i>p</i> -value				H-L <i>p</i> -value		
Panel A: IPO Underpricing										
<i>Exchange Listing</i>										
NASDAQ	21.98% <sup>a</sup> (32.12)	41.92% <sup>a</sup> (20.46)	13.44% <sup>a</sup> (25.62)	16.01% <sup>a</sup> (21.25)	25.91% <sup>a</sup> (11.87)	24.19% <sup>a</sup> (26.01)	19.01% <sup>a</sup> (17.59)	14.94% <sup>a</sup> (8.18)	9.25% <sup>a</sup> (4.52)	[0.000]
NYSE/AMEX	9.87% <sup>a</sup> (15.18)	10.99% <sup>a</sup> (8.28)	9.55% <sup>a</sup> (10.16)	9.47% <sup>a</sup> (9.02)	1.52% (0.90)	10.25% <sup>a</sup> (13.96)	8.33% <sup>a</sup> (9.78)	13.20% <sup>a</sup> (3.59)	-2.95% (-0.79)	[0.432]
<i>Gross Proceeds</i>										
Large (30%)	31.67% <sup>a</sup> (21.06)	56.39% <sup>a</sup> (17.21)	13.95% <sup>a</sup> (17.22)	14.97% <sup>a</sup> (11.28)	41.42% <sup>a</sup> (11.72)	33.42% <sup>a</sup> (16.47)	29.78% <sup>a</sup> (12.92)	14.49% <sup>a</sup> (3.59)	18.93% <sup>a</sup> (4.19)	[0.000]
Medium (40%)	18.12% <sup>a</sup> (23.38)	27.36% <sup>a</sup> (12.43)	13.98% <sup>a</sup> (16.88)	16.96% <sup>a</sup> (15.67)	10.40% <sup>a</sup> (4.24)	20.86% <sup>a</sup> (20.11)	12.16% <sup>a</sup> (11.72)	11.96% <sup>a</sup> (5.97)	8.90% <sup>a</sup> (3.94)	[0.000]
Small (30%)	10.46% <sup>a</sup> (19.99)	7.98% <sup>a</sup> (7.87)	10.51% <sup>a</sup> (14.76)	12.03% <sup>a</sup> (12.36)	-4.05% <sup>a</sup> (-2.88)	10.10% <sup>a</sup> (17.42)	9.38% <sup>a</sup> (12.13)	15.33% <sup>a</sup> (6.10)	-5.23% <sup>b</sup> (-2.03)	[0.044]

(continued)

**Table 5.8**—*Continued*

		Liquidity Demand ( $\Delta L/S$ )			Liquidity Supply ( <i>Debt/GDP</i> )		
		High	Medium	Low	Differences	High	Differences
		(30%)	(40%)	(30%)	H-L <i>p</i> -value	(30%)	H-L <i>p</i> -value
All							
Panel B: First-Month Return							
<i>Exchange Listing</i>							
NASDAQ	28.14% <sup>a</sup> (29.65)	54.27% <sup>a</sup> (19.16)	16.47% <sup>a</sup> (22.42)	21.99% <sup>a</sup> (17.95)	32.27% <sup>a</sup> (10.46)	32.27% <sup>a</sup> (25.03)	11.83% <sup>a</sup> (3.63)
NYSE/AMEX	11.57% <sup>a</sup> (12.36)	12.28% <sup>a</sup> (6.85)	10.93% <sup>a</sup> (8.04)	12.57% <sup>a</sup> (7.60)	−0.29% (−0.12)	12.55% <sup>a</sup> (11.74)	0.27% (0.06)
<i>Gross Proceeds</i>							
Large (30%)	38.48% <sup>a</sup> (18.77)	68.20% <sup>a</sup> (15.18)	16.59% <sup>a</sup> (13.34)	20.18% <sup>a</sup> (10.45)	48.02% <sup>a</sup> (9.82)	43.02% <sup>a</sup> (15.29)	26.46% <sup>a</sup> (4.71)
Medium (40%)	24.97% <sup>a</sup> (22.62)	39.92% <sup>a</sup> (12.70)	17.98% <sup>a</sup> (15.90)	24.04% <sup>a</sup> (13.79)	15.88% <sup>a</sup> (4.42)	29.26% <sup>a</sup> (20.59)	15.16% <sup>a</sup> (4.05)
Small (30%)	12.44% <sup>a</sup> (15.60)	10.14% <sup>a</sup> (4.82)	11.89% <sup>a</sup> (11.98)	15.64% <sup>a</sup> (9.06)	−5.51% <sup>b</sup> (−2.02)	11.92% <sup>a</sup> (12.40)	−7.43% <sup>b</sup> (−2.00)
Panel C: Money Left on the Table							
<i>Exchange Listing</i>							
NASDAQ	15.49	39.80	5.55	6.86	32.94 <sup>a</sup>	15.84	11.94 <sup>a</sup>
NYSE/AMEX	15.58	31.47	10.92	10.09	21.38 <sup>a</sup>	18.41	15.52 <sup>a</sup>
<i>Gross Proceeds</i>							
Large (30%)	40.61	74.66	16.29	17.39	57.27 <sup>a</sup>	39.60	24.37 <sup>a</sup>
Medium (40%)	7.42	12.08	5.40	6.66	5.43 <sup>a</sup>	8.56	4.23 <sup>a</sup>
Small (30%)	1.16	0.97	1.16	1.28	−0.31 <sup>c</sup>	1.26	−0.28

Panel B), and the amount of money left on the table (in Panel C) within different aggregate liquidity portfolios, which are further classified by exchange listing or value of gross proceeds. The positive correlation between aggregate liquidity and IPO underpricing remains strong for most of the cases. For instance, as shown in Panel A, the difference in IPO underpricing between high- and low-liquidity demand portfolios is 25.91% for IPOs listed on the Nasdaq, while this value drops to only 1.52% for IPOs listed on the NYSE/AMEX. However, considering that most of the firms choose the Nasdaq as the place to go public in preference to the NYSE/AMEX (almost a 6 to 1 ratio), it is not surprising that issuing firms on the Nasdaq have larger first-day returns. The bottom half of each panel shows the results of underpricing proxies when IPO deals are classified into three subgroups based on the level of gross proceeds. I find that the amount of proceeds in public equity offerings has a strong influence on the degree of IPO underpricing, where IPOs with higher (lower) gross proceeds experience larger (smaller) first-day and first-month returns. Moreover, the differences in underpricing between high- and low-liquidity portfolios are mostly concentrated in IPOs with large values of gross proceeds.

In summary, the underpricing of IPO, measured as first-day return, first-month return, and money left on the table, is strongly increased with the measures of aggregate liquidity demand and liquidity supply. These results further support the explanation power of aggregate liquidity on IPO activity, since the volume and underpricing of IPOs are positively correlated (see Yung, Çolak, and Wang (2008)). Thus, aggregate liquidity does have a substantial influence on the activity of initial equity offerings, as measured by IPO volume and underpricing.

### **5.3.3 Post-Issue Performance of IPOs**

Perhaps the most attractive research area in IPOs, as well as in SEOs, is the long-run stock price performance of issuing firms after public offering. Equity issuing firms are

found to have significantly negative performance over a five-year post-issue period, which is commonly recognised as the “new issue puzzle”. The underperformance of IPOs after public offering has been documented in many studies such as Ritter (1991), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995). However, many of the following studies argue that the long-run underperformance of issuing firms is not a special phenomenon for IPOs, but simply a consequence of an inappropriate methodology (see Brav and Gompers (1997) and Eckbo, Masulis, and Norli (2000)) or just a pattern in stock markets (see Brav, Geczy, and Gompers (2000)).

In this section, I use the factors of aggregate liquidity to partition the sample of IPOs into high-, medium-, and low-liquidity IPOs, and investigate whether the long-run underperformance “indeed” is the common pattern for all IPOs. In particular, I question whether IPOs announced when aggregate liquidity is high are substantially different from those announced in low-liquidity markets. To measure long-run performance, I use the buy-and-hold abnormal returns (BHAR), which is advocated by Barber and Lyon (1997) and Kothari and Warner (1997). The long-term BHAR is calculated as following:

$$BHAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N (BHR_{i, (T_1, T_2)} - BHR_{p_i, (T_1, T_2)}) \quad (5.1)$$

where

$$BHR_{i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{it}) - 1. \quad (5.2)$$

$$BHR_{p_i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} \left[ 1 + \frac{\sum_{j=1}^{N_t} R_{jt}}{N_t} \right] - 1 \quad (5.3)$$

Note that  $BHR_{i, (T_1, T_2)}$  is the buy-and-hold return (BHR) for firm  $i$  over period  $T_1$  to  $T_2$ .  $BHR_{p_i, (T_1, T_2)}$  is the BHR for firm  $i$ 's size and book-to-market reference portfolio over period  $T_1$  to  $T_2$ .  $N$  is the number of firms in the sample.  $T_2 - T_1$  is the horizon in the months over which abnormal returns are calculated. 12 months, 36 months,



**Table 5.9: One-Year Post-Issue BHAR of IPOs versus Aggregate Liquidity**

This table presents the one-year post-issue equal-weighted (in Panel A and C) and value-weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of IPO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t+1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel present BHAR using the S&P 500, CRSP value-weighted index, and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 12 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_i,T} = \prod_{t=1}^T (1 + R_{p_i,t}) - 1$  for benchmark index, or as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{j,t}^{p_i}/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{j,t}^{p_i}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_{i,T} = \sum_{i=1}^{N_T} \omega_i (BHR_{i,T} - BHR_{p_i,T})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5,090 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	Panel A: Liquidity Demand ( $\Delta L/S$ ) and Equal-Weighted BHAR												
	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR			
S&P 500 index ( <i>t</i> -statistic)	9.19%	-1.35% (-1.21)	-2.55%	-8.04% <sup>a</sup> (-3.05)	9.93%	-2.10% (-1.57)	24.21%	10.59% <sup>a</sup> (4.46)	-18.63% <sup>a</sup> (-5.25)				
CRSP VW index ( <i>t</i> -statistic)	9.19%	-2.91% <sup>a</sup> (-2.63)	-2.55%	-9.63% <sup>a</sup> (-3.69)	9.93%	-3.13% <sup>b</sup> (-2.36)	24.21%	7.56% <sup>a</sup> (3.20)	-17.19% <sup>a</sup> (-4.89)				
CRSP EW index ( <i>t</i> -statistic)	9.19%	-1.39% (-1.27)	-2.55%	-10.81% <sup>a</sup> (-4.14)	9.93%	1.08% (0.82)	24.21%	5.27% <sup>b</sup> (2.25)	-16.08% <sup>a</sup> (-4.59)				
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	9.03%	2.06% <sup>c</sup> (1.75)	-4.15%	-10.62% <sup>a</sup> (-3.85)	10.06%	5.57% <sup>a</sup> (3.94)	25.34%	10.60% <sup>a</sup> (4.22)	-21.22% <sup>a</sup> (-5.69)				

(continued)

Table 5.9—Continued

Benchmarks	All			High Liquidity		Medium Liquidity		Low Liquidity		Differences
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)	
	Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR									
S&P 500 index ( <i>t</i> -statistic)	-4.57%	-8.70% <sup>b</sup> (-2.48)	-20.19%	-17.91% <sup>a</sup> (-3.09)	13.61%	1.89% (0.53)	22.27%	7.49% <sup>b</sup> (2.26)	-25.40% <sup>a</sup> (-3.80)	
CRSP VW index ( <i>t</i> -statistic)	-4.57%	-10.04% <sup>a</sup> (-2.89)	-20.19%	-19.26% <sup>a</sup> (-3.35)	13.61%	0.98% (0.28)	22.27%	4.95% (1.51)	-24.21% <sup>a</sup> (-3.66)	
CRSP EW index ( <i>t</i> -statistic)	-4.57%	-13.26% <sup>a</sup> (-3.66)	-20.19%	-26.51% <sup>a</sup> (-4.42)	13.61%	4.41% (1.24)	22.27%	3.14% (0.92)	-29.64% <sup>a</sup> (-4.30)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	-5.31%	-10.02% <sup>a</sup> (-2.84)	-21.20%	-23.50% <sup>a</sup> (-4.08)	13.57%	7.90% <sup>b</sup> (2.18)	22.53%	8.26% <sup>b</sup> (2.47)	-31.77% <sup>a</sup> (-4.77)	
Panel C: Liquidity Supply ( <i>Debt/GDP</i> ) and Equal-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	9.19%	-1.35% (-1.21)	14.19%	-1.11% (-0.71)	-1.94%	-5.66% <sup>a</sup> (-3.61)	25.51%	22.54% <sup>a</sup> (4.92)	-23.65% <sup>a</sup> (-4.89)	
CRSP VW index ( <i>t</i> -statistic)	9.19%	-2.91% <sup>a</sup> (-2.63)	14.19%	-2.28% (-1.46)	-1.94%	-7.22% <sup>a</sup> (-4.65)	25.51%	16.92% <sup>a</sup> (3.75)	-19.20% <sup>a</sup> (-4.02)	
CRSP EW index ( <i>t</i> -statistic)	9.19%	-1.39% (-1.27)	14.19%	-0.34% (-0.22)	-1.94%	-5.06% <sup>a</sup> (-3.20)	25.51%	10.20% <sup>b</sup> (2.36)	-10.54% <sup>b</sup> (-2.30)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	9.03%	2.06% <sup>c</sup> (1.75)	13.73%	2.66% <sup>c</sup> (1.67)	-3.11%	-1.81% (-1.00)	27.76%	17.83% <sup>a</sup> (3.78)	-15.17% <sup>a</sup> (-3.05)	
Panel D: Liquidity Supply ( <i>Debt/GDP</i> ) and Value-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	-4.57%	-8.70% <sup>b</sup> (-2.48)	12.40%	0.65% (0.13)	-29.87%	-23.21% <sup>a</sup> (-4.83)	12.62%	12.31% <sup>b</sup> (2.26)	-11.66% (-1.57)	
CRSP VW index ( <i>t</i> -statistic)	-4.57%	-10.04% <sup>a</sup> (-2.89)	12.40%	-1.33% (-0.26)	-29.87%	-23.44% <sup>a</sup> (-5.01)	12.62%	6.94% (1.22)	-8.26% (-1.09)	
CRSP EW index ( <i>t</i> -statistic)	-4.57%	-13.26% <sup>a</sup> (-3.66)	12.40%	-3.21% (-0.63)	-29.87%	-28.38% <sup>a</sup> (-5.52)	12.62%	0.13% (0.02)	-3.35% (-0.43)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	-5.31%	-10.02% <sup>a</sup> (-2.84)	11.71%	-1.32% (-0.25)	-31.10%	-23.64% <sup>a</sup> (-5.68)	13.77%	8.60% (1.38)	-9.92% (-1.21)	

and 60 months post-issue BHAR are measured over months  $(+1, +12)$ ,  $(+1, +36)$ , and  $(+1, +60)$ , respectively, where month 0 is the announcement month for the IPOs. Size and book-to-market reference portfolios are constructed by following Fama and French (1993). The equally-weighted monthly returns of 25 reference portfolios formed on size and book-to-market  $(5 \times 5)$  are downloaded from Kenneth French's website. Issuing firms are assigned to 25 reference portfolios using the breakpoints for size and book-to-market.

By following Brav, Geczy, and Gompers (2000), various benchmarks are utilised to measure IPO and SEO long-run performance throughout this chapter. The performance of issuing firms is matched to the following broad market indexes: the S&P 500, the CRSP value-weighted index and the CRSP equal-weighted index. Moreover, I also construct benchmark portfolios by matching issuing firms with size and book-to-market reference portfolios. Besides calculating the equally-weighted BHAR, I also measure the value-weighted BHAR. For each issuing firm, I use the monthly data and follow each offering beginning in the month after the event for the earlier 60 months or the delisting month.

Table 5.9 presents long-run BHAR for all IPOs in the sample over a one-year period after issues. The buy-and-hold returns and the BHAR for issuing firms are both shown in the table. Panel A and Panel B show the results by measure of aggregate liquidity demand, while Panel C and Panel D show the results by measure of aggregate liquidity supply. For the whole IPO sample, the one-year post-issue abnormal returns are negative for all four benchmarks, and the degree of underperformance is much larger for value-weighted BHAR. For example, the one-year equally-weighted BHAR for the size and book-to-market reference portfolio is 2.06%. However, this value decreases to  $-10.02\%$  for the value-weighted BHAR. Such a difference confirms the long existing debates in the research on the topic of empirical results being affected by the methodology applied.

More importantly, Table 5.9 shows the raw BHR and BHAR of IPO firms in

**Table 5.10: Three-Year Post-Issue BHAR of IPOs versus Aggregate Liquidity**

This table presents the three-year post-issue equal-weighted (in Panel A and C) and value-weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of IPO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t+1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel presents BHAR measured relative to size and book-to-market portfolios and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 36 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{it} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_iT} = \prod_{t=1}^T (1 + R_{p_it}) - 1$  for benchmark index, or as  $BHR_{p_iT} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{jt}^{p_i}/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{jt}^{p_i}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_T = \sum_{i=1}^{N_T} \omega_i (BHR_{it} - BHR_{p_iT})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5,090 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences	
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)	
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>) and Equal-Weighted BHAR</b>														
S&P 500 index	31.11%	-7.12% <sup>a</sup>	9.66%	-3.43%	37.47%	-9.98% <sup>a</sup>	44.20%	-4.27%	44.20%	-9.98% <sup>a</sup>	44.20%	-4.27%	0.84%	
( $t$ -statistic)		(-2.58)		(-0.51)		(-2.94)		(-0.88)		(-2.94)		(-0.88)	(0.10)	
CRSP VW index	31.11%	-12.86% <sup>a</sup>	9.66%	-9.93%	37.47%	-14.61% <sup>a</sup>	44.20%	-12.12% <sup>b</sup>	44.20%	-14.61% <sup>a</sup>	44.20%	-12.12% <sup>b</sup>	2.20%	
( $t$ -statistic)		(-4.68)		(-1.47)		(-4.32)		(-2.55)		(-4.32)		(-2.55)	(0.27)	
CRSP EW index	31.11%	-6.61% <sup>b</sup>	9.66%	-23.10% <sup>a</sup>	37.47%	2.23%	44.20%	-7.91% <sup>c</sup>	44.20%	2.23%	44.20%	-7.91% <sup>c</sup>	-15.19% <sup>c</sup>	
( $t$ -statistic)		(-2.41)		(-3.39)		(0.66)		(-1.70)		(0.66)		(-1.70)	(-1.84)	
Size and Book-to-Market	30.55%	4.57%	6.31%	-15.23% <sup>b</sup>	38.41%	12.59% <sup>a</sup>	43.59%	10.68% <sup>b</sup>	43.59%	12.59% <sup>a</sup>	43.59%	10.68% <sup>b</sup>	-25.91% <sup>a</sup>	
( $t$ -statistic) (5090 obs)		(1.54)		(-2.10)		(3.44)		(2.14)		(3.44)		(2.14)	(-2.95)	

(continued)

Table 5.10—Continued

Benchmarks	All			High Liquidity		Medium Liquidity		Low Liquidity		Differences (High -Low)
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR		
Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	-2.87%	-16.28% <sup>a</sup> (-4.33)	-37.77%	-24.15% <sup>a</sup> (-4.61)	45.27%	-2.21% (-0.33)	35.78%	-16.66% <sup>b</sup> (-2.33)	-7.49% (-0.85)	
CRSP VW index ( <i>t</i> -statistic)	-2.87%	-21.16% <sup>a</sup> (-5.64)	-37.77%	-29.19% <sup>a</sup> (-5.57)	45.27%	-6.57% (-0.99)	35.78%	-22.24% <sup>a</sup> (-3.24)	-6.95% (-0.80)	
CRSP EW index ( <i>t</i> -statistic)	-2.87%	-32.00% <sup>a</sup> (-7.14)	-37.77%	-58.10% <sup>a</sup> (-8.57)	45.27%	7.43% (1.14)	35.78%	-12.86% <sup>b</sup> (-2.18)	-45.24% <sup>a</sup> (-5.04)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	-4.19%	-16.73% <sup>a</sup> (-4.22)	-39.56%	-36.69% <sup>a</sup> (-6.64)	46.20%	13.67% <sup>c</sup> (1.95)	34.14%	-0.57% (-0.09)	-36.12% <sup>a</sup> (-4.16)	
Panel C: Liquidity Supply ( $Debt/GDP$ ) and Equal-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	31.11%	-7.12% <sup>a</sup> (-2.58)	33.55%	-14.00% <sup>a</sup> (-3.60)	21.09%	-3.49% (-0.88)	67.10%	41.90% <sup>a</sup> (3.99)	-55.90% <sup>a</sup> (-4.99)	
CRSP VW index ( <i>t</i> -statistic)	31.11%	-12.86% <sup>a</sup> (-4.68)	33.55%	-16.75% <sup>a</sup> (-4.33)	21.09%	-12.18% <sup>a</sup> (-3.09)	67.10%	23.30% <sup>b</sup> (2.24)	-40.10% <sup>a</sup> (-3.61)	
CRSP EW index ( <i>t</i> -statistic)	31.11%	-6.61% <sup>b</sup> (-2.41)	33.55%	-8.13% <sup>b</sup> (-2.10)	21.09%	-5.66% (-1.42)	67.10%	3.40% (0.34)	-11.60% (-1.07)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	30.55%	4.57% (1.54)	33.12%	2.99% (0.74)	19.05%	2.95% (0.65)	68.60%	30.90% <sup>a</sup> (2.79)	-27.90% <sup>b</sup> (-2.36)	
Panel D: Liquidity Supply ( $Debt/GDP$ ) and Value-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	-2.87%	-16.28% <sup>a</sup> (-4.33)	5.26%	-18.93% <sup>a</sup> (-3.55)	-16.90%	-14.22% <sup>a</sup> (-2.67)	44.30%	19.50% <sup>c</sup> (1.74)	-38.40% <sup>a</sup> (-3.10)	
CRSP VW index ( <i>t</i> -statistic)	-2.87%	-21.16% <sup>a</sup> (-5.64)	5.26%	-22.05% <sup>a</sup> (-4.12)	-16.90%	-20.97% <sup>a</sup> (-3.99)	44.30%	1.20% (0.10)	-23.20% <sup>c</sup> (-1.74)	
CRSP EW index ( <i>t</i> -statistic)	-2.87%	-32.00% <sup>a</sup> (-7.14)	5.26%	-27.45% <sup>a</sup> (-4.53)	-16.90%	-39.22% <sup>a</sup> (-5.67)	44.30%	-18.60% (-1.35)	-8.80% (-0.59)	
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	-4.19%	-16.73% <sup>a</sup> (-4.22)	3.90%	-11.99% <sup>b</sup> (-2.11)	-18.46%	-25.00% <sup>a</sup> (-4.59)	44.90%	10.60% (0.90)	-22.60% <sup>c</sup> (-1.72)	

**Table 5.11: Five-Year Post-Issue BHAR of IPOs versus Aggregate Liquidity**

This table presents the five-Year post-issue equal-weighted (in Panel A and C) and value-weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of IPO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of IPOs consists of 5,529 IPOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. IPOs announced in next year of  $(t+1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel present BHAR using the S&P 500, CRSP value-weighted index, and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 60 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_i,T} = \prod_{t=1}^T (1 + R_{p_i,t}) - 1$  for benchmark index, or as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{jt}^p/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{jt}^p$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_T = \sum_{i=1}^{N_T} \omega_i (BHR_{i,T} - BHR_{p_i,T})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5,090 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences	
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)	
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>) and Equal-Weighted BHAR</b>														
S&P 500 index ( $t$ -statistic)	52.93%	-7.92% (-1.53)	7.74%	-5.46% (-0.76)	57.88%	-18.29% <sup>b</sup> (-2.37)	104.80%	18.30% (1.47)					-23.80% <sup>c</sup> (-1.65)	
CRSP VW index ( $t$ -statistic)	52.93%	-18.86% <sup>a</sup> (-3.66)	7.74%	-16.49% <sup>b</sup> (-2.31)	57.88%	-26.77% <sup>a</sup> (-3.46)	104.80%	0.40% (0.04)					-16.90% (-1.18)	
CRSP EW index ( $t$ -statistic)	52.93%	-12.37% <sup>b</sup> (-2.39)	7.74%	-50.14% <sup>a</sup> (-6.96)	57.88%	0.55% (0.07)	104.80%	5.70% (0.46)					-55.90% <sup>a</sup> (-3.89)	
Size and Book-to-Market ( $t$ -statistic) (5090 obs)	53.45%	6.61% (1.17)	4.57%	-34.73% <sup>a</sup> (-4.46)	60.43% <sup>c</sup> (2.07)	17.48% <sup>b</sup> (2.07)	105.00%	36.10% <sup>a</sup> (2.69)					-70.80% <sup>a</sup> (-4.56)	

(continued)

Table 5.11—Continued

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences (High -Low)
	Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		
Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR													
S&P 500 index ( <i>t</i> -statistic)	14.63%	-16.13% <sup>a</sup> (-3.41)	-34.06%	-27.17% <sup>a</sup> (-4.25)	74.70%	-2.18% (-0.26)	88.80%	-0.20% (-0.02)					-27.00% <sup>c</sup> (-1.89)
CRSP VW index ( <i>t</i> -statistic)	14.63%	-26.20% <sup>a</sup> (-5.51)	-34.06%	-37.49% <sup>a</sup> (-5.79)	74.70%	-10.16% (-1.24)	88.80%	-15.00% (-1.18)					-22.50% (-1.57)
CRSP EW index ( <i>t</i> -statistic)	14.63%	-53.16% <sup>a</sup> (-7.75)	-34.06%	-100.50% <sup>a</sup> (-9.54)	74.70%	13.58% (1.54)	88.80%	-4.80% (-0.39)					-95.80% <sup>a</sup> (-5.95)
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	13.84%	-24.31% <sup>a</sup> (-4.64)	-35.90%	-57.51% <sup>a</sup> (-7.90)	76.90%	21.61% <sup>b</sup> (2.56)	89.70%	15.60% (1.15)					-73.10% <sup>a</sup> (-4.74)
Panel C: Liquidity Supply ( <i>Debt/GDP</i> ) and Equal-Weighted BHAR													
S&P 500 index ( <i>t</i> -statistic)	52.93%	-7.92% (-1.53)	57.00%	-15.73% <sup>b</sup> (-2.11)	36.69%	-3.29% (-0.48)	110.20%	44.50% <sup>b</sup> (2.19)					-60.20% <sup>a</sup> (-2.78)
CRSP VW index ( <i>t</i> -statistic)	52.93%	-18.86% <sup>a</sup> (-3.66)	57.00%	-21.44% <sup>a</sup> (-2.88)	36.69%	-18.88% <sup>a</sup> (-2.76)	110.20%	8.00% (0.40)					-29.50% (-1.37)
CRSP EW index ( <i>t</i> -statistic)	52.93%	-12.37% <sup>b</sup> (-2.39)	57.00%	-14.34% <sup>c</sup> (-1.92)	36.69%	-9.57% (-1.39)	110.20%	-9.10% (-0.46)					-5.30% (-0.25)
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	53.45%	6.61% (1.17)	56.65%	4.97% (0.63)	36.91%	2.99% (0.38)	113.70%	45.10% <sup>b</sup> (2.11)					-40.10% <sup>c</sup> (-1.76)
Panel D: Liquidity Supply ( <i>Debt/GDP</i> ) and Value-Weighted BHAR													
S&P 500 index ( <i>t</i> -statistic)	14.63%	-16.13% <sup>a</sup> (-3.41)	21.68%	-21.88% <sup>a</sup> (-3.75)	1.73%	-9.04% (-1.10)	70.30%	8.50% (0.47)					-30.40% (-1.59)
CRSP VW index ( <i>t</i> -statistic)	14.63%	-26.20% <sup>a</sup> (-5.51)	21.68%	-29.06% <sup>a</sup> (-4.90)	1.73%	-22.04% <sup>a</sup> (-2.71)	70.30%	-27.10% (-1.35)					-1.90% (-0.09)
CRSP EW index ( <i>t</i> -statistic)	14.63%	-53.16% <sup>a</sup> (-7.75)	21.68%	-51.76% <sup>a</sup> (-5.79)	1.73%	-55.60% <sup>a</sup> (-4.97)	70.30%	-44.90% <sup>b</sup> (-2.24)					-6.80% (-0.31)
Size and Book-to-Market ( <i>t</i> -statistic) (5090 obs)	13.84%	-24.31% <sup>a</sup> (-4.64)	20.91%	-18.78% <sup>a</sup> (-2.74)	0.65%	-33.81% <sup>a</sup> (-3.99)	71.30%	4.50% (0.24)					-23.30% (-1.18)

various liquidity portfolios. The one-year BHAR is negatively correlated with aggregate liquidity factors. Even the raw IPO buy-and-hold returns show some degree of correlation with aggregate liquidity. The differences between high- and low-liquidity portfolios are all negative and mostly significant, regardless of the measures of aggregate liquidity measures and calculation of BHAR. Across the table, the BHAR results reveal that aggregate liquidity, especially liquidity demand, has a strong negative correlation with long-run post-issue performance. In other words, the commonly recognised IPO long-run underperformance is actually driven, in part, by issuing firms going public in a period of high aggregate liquidity. Those IPOs in low aggregate liquidity markets even have significantly positive abnormal returns over one year after issues.

Table 5.10 and Table 5.11 show the long-run BHAR over a three-year and five-year horizon, respectively. In general, the results show that IPO firms suffer serious long-run underperformance, measured by four different benchmarks. The degree of underperformance increases with the horizon of the post-issue period. Second, the negative correlation between aggregate liquidity and post-issue BHAR becomes stronger when the time-horizon increases. IPOs announced in periods of high aggregate liquidity have large and significantly negative abnormal returns. However, IPOs announced in periods of low aggregate liquidity have positive post-issue abnormal returns.

To sum up, in addition to IPO activity and IPO underpricing, aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate corporate liquidity supply ( $Debt/GDP$ ) both show a strong correlation with long-run post-issue abnormal returns. Moreover, post-issue returns are only “abnormal” for IPOs announced in high aggregate liquidity markets. Issuing firms going public in a low aggregate liquidity environment event have long-term positive abnormal returns. These results are generally consistent throughout the four different benchmarks. Further, as the degree of underperformance increases with the post-issue time period, the differences of buy-and-hold



abnormal returns between high- and low-liquidity portfolios increase as well. These results suggest the existence of a “window of opportunity”. Other than identifying these opportunities with volume of equity offerings, I find that aggregate liquidity factors turn out to be a stronger identifier, since IPOs in periods of low aggregate liquidity benefits in the long-run via positive stock returns.

## 5.4 Empirical Results for SEO firms

In this section, the correlation between aggregate liquidity and public equity issues is examined with the sample of SEOs.

### 5.4.1 Volume and Proceeds of SEOs

In the SEO literature, Choe, Masulis, and Nanda (1993) document pro-cyclical SEO activity. Table 5.12 reports the number of SEOs and gross proceeds within different aggregate liquidity portfolios for the SEO sample. Panel A shows the results for aggregate liquidity demand portfolios, while panel B shows the results for aggregate liquidity supply portfolios. Similar to empirical results for the IPO sample, the aggregate liquidity also significantly influences the activity of SEOs. It seems that managers choose the timing for additional public offerings by considering the level of aggregate liquidity.

The difference between the number of SEOs for high- and low-liquidity demand portfolios is 186. This value increases to 2,192 when comparing liquidity supply portfolios. SEO proceeds are also used as a proxy for SEO activity. Mean and median proceeds values for the whole SEO sample and various liquidity portfolios are calculated. The differences between median value of high- and low-liquidity portfolios are positive and significant at 1%. The results of SEO proceeds, consistent with the SEO number, suggest a positive correlation between aggregate liquidity and SEO activity. SEO volume increases in both aggregate liquidity factors.

**Table 5.12: SEO Activity versus Aggregate Liquidity**

This table presents the number of SEOs and gross proceeds within different aggregate liquidity portfolios for the SEO sample. Panel A (Panel B) reports the results for liquidity demand (supply) portfolios. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years  $(t)$  are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Gross proceeds is the amount raised from investors in millions (2004 purchasing power using the CPI, local market offering amount, excluding overallotment options). Statistical significance on mean and median values are based on  $t$ -tests and Wilcoxon tests, respectively.  $p$ -values are reported in brackets. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

		High (30%)	Medium (40%)	Low (30%)	Differences	
All					H-L	$p$ -value
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>						
Number of SEOs	6,100	1,667	2,952	1,481	186	
Gross Proceeds (\$ millions)						
Mean	106.31	151.14	88.58	91.19	59.95 <sup>a</sup>	[0.000]
Median	56.89	82.34	49.07	49.58	32.76 <sup>a</sup>	[0.000]
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>						
Number of SEOs	6,100	2,902	2,488	710	2,192	
Gross Proceeds (\$ millions)						
Mean	106.31	101.84	115.8	91.31	10.53	[0.159]
Median	56.89	58.57	58.14	42.2	16.37 <sup>a</sup>	[0.000]

To further explore whether this positive correlation is driven by other factors, I classify the sample of SEOs by exchange listing and gross proceeds. Subsamples of SEOs listed on the Nasdaq or NYSE/AMEX are created. In addition, the sample of SEOs is partitioned into subsamples with highest (30%), medium (40%), and lowest (30%) gross proceeds levels. Panel B of Table 5.5 shows the frequency distribution of issuing firms across aggregate liquidity portfolios ( $\Delta L/S$  or *Debt/GDP*) and offering characteristics for the sample of SEOs. The left sub-panel presents the frequency distribution created by the intersection between the aggregate liquidity demand portfolios ( $\Delta L/S$ ) and exchange listing (i.e. Nasdaq or NYSE/AMEX) or gross proceeds value (i.e. highest(30%), medium(40%), lowest(30%)). Unlike IPOs, the distribution of seasoned equity offerings across the Nasdaq and NYSE/AMEX is similar, with slightly more SEO undertaken in the Nasdaq. The distribution of the number of SEOs across high-, medium-, and low-liquidity portfolios is similar to that of the IPO sample. The number of SEOs is positively correlated with aggregate liquidity measures.

### 5.4.2 Discounting of SEOs

While IPO underpricing has received extensive attention in the literature, SEO discounting has attracted relatively less attention. In general, discounting if the offer price in firm underwritten SEOs is economically large and common, remained stable around 3% throughout the 1990s (Altinkılıç and Hansen (2003)). Mola and Loughran (2004) find that the average offering of new equity has a 3% discounting level, which rises steadily over time. They also find evidence of the increased clustering of offer prices at integers and conclude that clustering is a significant determinant of SEO discounting. Corwin (2003) examine the relative importance of various hypotheses in explaining the cross-section of SEO discounting. Corwin find that discounting is positively related to offer size, price uncertainty, and underwriter pricing conventions.

To be consistent with the IPO sample, I also apply three proxies for SEO discounting. The discounting of IPO is also called ‘underpricing’ in some studies (e.g. Corwin (2003)). To distinguish between them, SEO discounting, denoted by  $D = (P_{-1} - P_0)/P_0$ , is defined as the percentage price change between the prior offer day’s closing price ( $P_{-1}$ ) and the offer price ( $P_0$ ), relative to the offer price. By following Mola and Loughran (2004), the SEO money left on the table is measured as the dollar discount ( $P_{-1} - P_0$ ) multiplied by the number of shares in the offering, and expressed in millions of constant 2004 dollars. Although IPO underpricing and SEO discounting are both measured as close-to-offer returns, the close price for IPO underpricing and SEO discounting is the first available closing price and the prior day’s closing price, respectively.

Table 5.13 presents the discounting of SEOs, first-month returns, and the amount of money left on the table within different aggregate liquidity portfolios for the SEO sample. Panel A (Panel B) reports the results for liquidity demand (supply) portfolios. Both the mean and median values for the whole sample and each aggregate liquidity are reported. The SEO discounting (4.17%) is much smaller than the IPO underpricing (19.89%), while the SEO first-month return (6.18%) is only slightly larger than the SEO discounting. For the sample of SEOs, the difference between high- and low-liquidity portfolios in SEO discounting is 1.33% and significant at the 1% level. Again, this value is smaller for the SEO sample in magnitude than the IPO underpricing differences (22.56%). The results in Table 5.13 show that all differences (mean and median) between high- and low-liquidity portfolios are positive, except for the difference of SEO first-month return between liquidity demand portfolios, which is negative (−2.87%) and significant.

Overall, these results suggest a positive correlation between aggregate liquidity and SEO discounting. To avoid potential data problems with the SDC, the median values of SEO discounting are also examined. Although median values are usually

**Table 5.13: Discounting of SEOs versus Aggregate Liquidity**

This table presents the discounting of SEOs, first-month returns, and amount of money left on the table within different aggregate liquidity portfolios for the SEO sample. Panel A (Panel B) reports the results for liquidity demand (supply) portfolios. The sample of SEOs consists of 6, 100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left subpanel reports the mean value and the right subpanel reports the median value. The SEO discounting is measured as the percent price change between prior day's closing price and the offer price, relative to the offer price. The first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the prior day's closing price. Statistical significance on mean and median value are based on  $t$ -tests and Wilcoxon tests, respectively.  $t$ -statistics are reported in parentheses.  $p$ -values are reported in brackets. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

	Mean					Median				
	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)	All	High (30%)	Medium (40%)	Low (30%)	Differences (High-Low)
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>										
Discounting	4.17% <sup>a</sup> (19.40)	4.71% <sup>a</sup> (14.55)	4.26% <sup>a</sup> (11.32)	3.38% <sup>a</sup> (11.44)	1.33% <sup>a</sup> (3.05)	1.70% <sup>a</sup> [0.000]	2.63% <sup>a</sup> [0.000]	1.35% <sup>a</sup> [0.000]	1.54% <sup>a</sup> [0.000]	1.09% <sup>a</sup> [0.000]
First-Month Return	6.18% <sup>a</sup> (23.18)	4.95% <sup>a</sup> (9.32)	6.05% <sup>a</sup> (15.56)	7.82% <sup>a</sup> (15.80)	-2.87% <sup>a</sup> (-3.95)	4.17% <sup>a</sup> [0.000]	2.97% <sup>a</sup> [0.000]	4.10% <sup>a</sup> [0.000]	5.44% <sup>a</sup> [0.000]	-2.48% <sup>a</sup> [0.000]
Money Left on the Table (\$ millions)	3.87	6.27	3.06	2.78	3.48 <sup>a</sup> (3.78)	0.76	1.68	0.57	0.61	1.07 <sup>a</sup> [0.000]
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>										
Discounting	4.17% <sup>a</sup> (19.40)	4.62% <sup>a</sup> (18.83)	4.19% <sup>a</sup> (10.01)	2.24% <sup>a</sup> (4.55)	2.38% <sup>a</sup> (4.32)	1.70% <sup>a</sup> [0.000]	2.38% <sup>a</sup> [0.000]	1.31% <sup>a</sup> [0.000]	0.52% <sup>a</sup> [0.000]	1.86% <sup>a</sup> [0.000]
First-Month Return	6.18% <sup>a</sup> (23.18)	7.16% <sup>a</sup> (21.00)	5.72% <sup>a</sup> (11.59)	3.77% <sup>a</sup> (6.96)	3.39% <sup>a</sup> (5.29)	4.17% <sup>a</sup> [0.000]	4.80% <sup>a</sup> [0.000]	3.94% <sup>a</sup> [0.000]	3.12% <sup>a</sup> [0.000]	1.68% <sup>a</sup> [0.000]
Money Left on the Table (\$ millions)	3.87	3.86	4.58	1.38	2.48 <sup>a</sup> (4.68)	0.76	1.21	0.50	0.16	1.05 <sup>a</sup> [0.000]

**Table 5.14: Discounting of SEOs across Aggregate Liquidity and Offering Characteristics**

This table presents the discounting of SEOs (in Panel A), first-month returns (in Panel B), and amount of money left on the table (in Panel C) within different aggregate liquidity portfolios, which is further classified by exchange listing (i.e. NASDAQ or NYSE/AMEX) or gross proceeds (i.e. large (30%), medium (40%), small (30%)). The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. In each panel, the left subpanel reports the results for liquidity demand portfolios based on  $\Delta L/Sources$  and the right subpanel reports the results for liquidity supply portfolios based on  $Debt/GDP$ . The SEO discounting is measured as the percent price change between prior day's closing price and the offer price, relative to the offer price. The first-month return is measured as the percent price change between the 21st trading day's closing price and the offer price, relative to the offer price. Money left on the table (millions of dollars, 2004 purchasing power) is calculated as the number of shares issued times the change from the offer price to the prior day's closing price. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

		Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )					
		High (30%)	Medium (40%)	Low (30%)	Differences		High (30%)	Medium (40%)	Low (30%)	Differences	
					H-L	p-value				H-L	p-value
Panel A: SEO Discounting											
<i>Exchange Listing</i>											
NASDAQ	4.53% <sup>a</sup> (24.31)	5.41% <sup>a</sup> (15.97)	4.07% <sup>a</sup> (17.80)	4.28% <sup>a</sup> (8.75)	1.13% <sup>c</sup> (1.90)	5.15% <sup>a</sup> (18.34)	4.08% <sup>a</sup> (16.89)	1.36% <sup>c</sup> (1.89)	3.79% <sup>a</sup> (4.92)	[0.000]	
NYSE/AMEX	3.65% <sup>a</sup> (8.16)	3.37% <sup>a</sup> (4.95)	4.50% <sup>a</sup> (5.54)	2.24% <sup>a</sup> (8.89)	1.12% (1.55)	3.49% <sup>a</sup> (7.27)	4.34% <sup>a</sup> (4.70)	2.55% <sup>a</sup> (4.15)	0.94% (1.21)	[0.228]	
<i>Gross Proceeds</i>											
Large (30%)	3.66% <sup>a</sup> (7.96)	3.79% <sup>a</sup> (12.61)	4.13% <sup>a</sup> (3.82)	2.43% <sup>a</sup> (6.69)	1.37% <sup>a</sup> (2.90)	3.25% <sup>a</sup> (9.26)	4.52% <sup>a</sup> (4.78)	1.41% <sup>b</sup> (2.21)	1.85% <sup>b</sup> (2.54)	[0.012]	
Medium (40%)	3.67% <sup>a</sup> (12.96)	4.78% <sup>a</sup> (10.02)	3.41% <sup>a</sup> (7.73)	3.06% <sup>a</sup> (5.65)	1.73% <sup>b</sup> (2.40)	4.20% <sup>a</sup> (9.42)	3.32% <sup>a</sup> (10.24)	2.30% <sup>b</sup> (2.36)	1.90% <sup>c</sup> (1.78)	[0.076]	
Small (30%)	5.33% <sup>a</sup> (13.45)	6.69% <sup>a</sup> (5.35)	5.34% <sup>a</sup> (9.73)	4.47% <sup>a</sup> (9.04)	2.22% <sup>c</sup> (1.65)	6.80% <sup>a</sup> (17.96)	4.84% <sup>a</sup> (5.96)	2.66% <sup>a</sup> (3.55)	4.14% <sup>a</sup> (4.92)	[0.000]	

(continued)

**Table 5.14—Continued**

		Liquidity Demand ( $\Delta L/S$ )				Liquidity Supply ( $Debt/GDP$ )						
		High (30%)	Medium (40%)	Low (30%)	Difference H-L <i>p</i> -value	High (30%)	Medium (40%)	Low (30%)	Difference H-L <i>p</i> -value			
Panel B: First-Month Return												
Exchange Listing												
NASDAQ	7.22% <sup>a</sup> (18.94)	5.70% <sup>a</sup> (7.68)	7.09% <sup>a</sup> (13.17)	9.50% <sup>a</sup> (12.42)	−3.80% <sup>a</sup> (−3.57)	[0.000]	7.94% <sup>a</sup> (17.24)	6.60% <sup>a</sup> (9.45)	4.20% <sup>a</sup> (3.62)	3.75% <sup>a</sup> (3.01)	[0.003]	
	NYSE/AMEX	4.71% <sup>a</sup> (13.48)	3.53% <sup>a</sup> (5.74)	4.70% <sup>a</sup> (8.47)	5.73% <sup>a</sup> (10.19)	−2.20% <sup>a</sup> (−2.64)	[0.008]	5.49% <sup>a</sup> (13.28)	4.55% <sup>a</sup> (6.72)	3.63% <sup>a</sup> (5.95)	1.86% <sup>b</sup> (2.53)	[0.012]
Gross Proceeds												
Large (30%)	4.98% <sup>a</sup> (10.11)	3.85% <sup>a</sup> (4.53)	5.67% <sup>a</sup> (6.90)	5.83% <sup>a</sup> (8.54)	−1.98% <sup>c</sup> (−1.82)	[0.070]	5.99% <sup>a</sup> (10.57)	4.19% <sup>a</sup> (4.60)	3.73% <sup>a</sup> (4.80)	2.27% <sup>b</sup> (2.36)	[0.019]	
	Medium (40%)	6.18% <sup>a</sup> (16.76)	6.14% <sup>a</sup> (7.17)	5.70% <sup>a</sup> (12.47)	7.15% <sup>a</sup> (9.40)	−1.01% (−0.89)	[0.376]	7.39% <sup>a</sup> (13.58)	5.51% <sup>a</sup> (9.43)	2.56% <sup>a</sup> (3.21)	4.83% <sup>a</sup> (4.99)	[0.000]
	Small (30%)	7.39% <sup>a</sup> (13.38)	5.13% <sup>a</sup> (4.74)	6.74% <sup>a</sup> (8.52)	10.12% <sup>a</sup> (10.07)	−5.00% <sup>a</sup> (−3.38)	[0.001]	8.06% <sup>a</sup> (12.20)	7.62% <sup>a</sup> (7.17)	4.93% <sup>a</sup> (4.74)	3.13% <sup>b</sup> (2.55)	[0.011]
Panel C: Money Left on the Table												
Exchange Listing												
NASDAQ	3.60	6.94	1.87	2.68	4.25 <sup>a</sup>	[0.001]	3.35	4.39	0.26	3.09 <sup>a</sup>	[0.000]	
	NYSE/AMEX	4.24	4.98	4.60	2.90	2.08 <sup>c</sup>	[0.095]	4.95	4.85	1.77	3.18 <sup>a</sup>	[0.004]
Gross Proceeds												
Large (30%)	9.21	11.52	7.86	7.37	4.15	[0.125]	8.66	11.04	2.70	5.96 <sup>a</sup>	[0.000]	
	Medium (40%)	2.09	2.72	1.93	1.73	0.99 <sup>a</sup>	[0.008]	2.28	1.98	1.53	0.74	[0.282]
	Small (30%)	0.89	1.19	0.87	0.73	0.46 <sup>b</sup>	[0.011]	1.26	0.65	0.50	0.76 <sup>a</sup>	[0.000]

smaller than mean values, they show consistent patterns in most of the cases. Table 5.14 presents the discounting of SEOs, first-month returns and the amount of money left on the table within different aggregate liquidity portfolios, which is further classified by exchange listing (i.e. NASDAQ or NYSE/AMEX) or gross proceeds value (i.e. highest(30%), medium(40%), lowest(30%)). Without exception, the major results produce the same patterns and correlations after controlling for these deal characteristics.

### 5.4.3 Post-Issue Performance of SEOs

This section investigates the correlation between aggregate liquidity and the long-run post-issue performance of SEO firms. Equity offering firms in SEOs are found to have long-run negative abnormal returns (see Levis (1995), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995)). The long-run abnormal performance of SEOs is measured by employing the same methodology for long-term returns (BHAR).

Table 5.15, Table 5.16, and Table 5.17 report the long-run BHAR for the sample of SEOs over one-year, three-year, and five-year periods after the announcements of SEOs, respectively. For the entire SEO sample, issuing firms underperform against various benchmarks in the five-year period after equity offerings. The degree of underperformance increases with the length of post-issue period. Although SEO firms have negative abnormal returns after public offering, the degree of underperformance is relatively smaller when related to IPO firms. These results are consistent with previously documented findings in the literature of SEO.<sup>9</sup>

In general, for the SEO sample, the return differentials between high- and low-liquidity portfolios are negative and mostly significant. When using reference portfolios as benchmarks, the three-year equally-weighted (value-weighted) BHAR difference between high- and low-liquidity SEO is  $-11.15\%$  ( $-22.29$ ) for liquidity demand

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<sup>9</sup>See Ritter (2003) for reviews on IPO and SEO long-term performance.



**Table 5.15: One-Year Post-Issue BHAR of SEOs versus Aggregate Liquidity**

This table presents the one-year post-issue equal weighted (in Panel A and C) and value weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of SEO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel present BHAR using the S&P 500, CRSP value-weighted index, and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 12 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_i,T} = \prod_{t=1}^T (1 + R_{p_i,t}) - 1$  for benchmark index, or as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{jt}^{p_i}/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{jt}^{p_i}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_{i,T} = \sum_{i=1}^{N_T} \omega_i (BHR_{i,T} - BHR_{p_i,T})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5,856 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	All				High Liquidity				Medium Liquidity				Low Liquidity				Differences	
	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	(High -Low)	
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>) and Equal-Weighted BHAR</b>																		
S&P 500 index ( $t$ -statistic)	9.77%	-0.83% (-0.91)	3.54%	-0.86% (-0.39)	5.66%	-6.26% <sup>a</sup> (-5.75)	24.96%	10.02% <sup>a</sup> (5.81)	-10.88% <sup>a</sup> (-3.88)									
CRSP VW index ( $t$ -statistic)	9.77%	-3.15% <sup>a</sup> (-3.52)	3.54%	-2.69% (-1.23)	5.66%	-7.87% <sup>a</sup> (-7.33)	24.96%	5.73% <sup>a</sup> (3.36)	-8.42% <sup>a</sup> (-3.04)									
CRSP EW index ( $t$ -statistic)	9.77%	-4.28% <sup>a</sup> (-4.88)	3.54%	-5.22% <sup>b</sup> (-2.44)	5.66%	-5.19% <sup>a</sup> (-4.91)	24.96%	-1.42% (-0.84)	-3.80% (-1.40)									
Size and Book-to-Market ( $t$ -statistic) (5856 obs)	9.79%	-0.10% (-0.12)	3.18%	-1.24% (-0.58)	5.80%	-1.39% (-1.30)	25.12%	3.72% <sup>b</sup> (2.18)	-4.96% <sup>c</sup> (-1.82)									

(continued)

Table 5.15—Continued

Benchmarks	All		High Liquidity		Medium Liquidity		Low Liquidity		Difference (High -Low)
	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	Raw SEO Return	Abnormal BHAR	
Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR									
S&P 500 index ( <i>t</i> -statistic)	9.20%	1.74% (0.89)	2.39%	3.11% (0.75)	9.34%	-2.13% (-1.39)	22.55%	5.00% <sup>b</sup> (2.31)	-1.89% (-0.40)
CRSP VW index ( <i>t</i> -statistic)	9.20%	-1.09% (-0.57)	2.39%	0.82% (0.21)	9.34%	-4.03% <sup>b</sup> (-2.54)	22.55%	-0.35% (-0.14)	1.17% (0.25)
CRSP EW index ( <i>t</i> -statistic)	9.20%	-7.13% <sup>a</sup> (-3.36)	2.39%	-7.14% <sup>c</sup> (-1.80)	9.34%	-2.97% (-1.62)	22.55%	-13.52% <sup>a</sup> (-2.85)	6.38% (1.03)
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	9.23%	-1.44% (-0.75)	2.34%	0.71% (0.18)	9.36%	-3.64% <sup>c</sup> (-1.92)	22.95%	-2.37% (-0.96)	3.08% (0.67)
Panel C: Liquidity Supply ( <i>Debt/GDP</i> ) and Equal-Weighted BHAR									
S&P 500 index ( <i>t</i> -statistic)	9.77%	-0.83% (-0.91)	15.59%	-1.07% (-0.67)	-0.48%	-4.91% <sup>a</sup> (-4.78)	21.89%	14.46% <sup>a</sup> (6.25)	-15.53% <sup>a</sup> (-5.53)
CRSP VW index ( <i>t</i> -statistic)	9.77%	-3.15% <sup>a</sup> (-3.52)	15.59%	-2.36% (-1.50)	-0.48%	-7.22% <sup>a</sup> (-7.13)	21.89%	7.89% <sup>a</sup> (3.49)	-10.26% <sup>a</sup> (-3.72)
CRSP EW index ( <i>t</i> -statistic)	9.77%	-4.28% <sup>a</sup> (-4.88)	15.59%	-0.22% (-0.15)	-0.48%	-9.56% <sup>a</sup> (-9.42)	21.89%	-2.39% (-1.10)	2.17% (0.81)
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	9.79%	-0.10% (-0.12)	15.67%	3.20% <sup>b</sup> (2.08)	-0.97%	-5.02% <sup>a</sup> (-4.96)	22.09%	2.96% (1.33)	0.25% (0.09)
Panel D: Liquidity Supply ( <i>Debt/GDP</i> ) and Value-Weighted BHAR									
S&P 500 index ( <i>t</i> -statistic)	9.20%	1.74% (0.89)	23.02%	9.37% <sup>b</sup> (2.33)	-5.19%	-5.97% <sup>a</sup> (-2.62)	16.20%	4.91% (1.51)	4.47% (0.86)
CRSP VW index ( <i>t</i> -statistic)	9.20%	-1.09% (-0.57)	23.02%	7.28% <sup>c</sup> (1.85)	-5.19%	-8.16% <sup>a</sup> (-3.81)	16.20%	-1.75% (-0.51)	9.04% <sup>c</sup> (1.73)
CRSP EW index ( <i>t</i> -statistic)	9.20%	-7.13% <sup>a</sup> (-3.36)	23.02%	5.66% (1.51)	-5.19%	-15.46% <sup>a</sup> (-6.08)	16.20%	-15.43% <sup>b</sup> (-2.36)	21.09% <sup>a</sup> (2.80)
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	9.23%	-1.44% (-0.75)	23.07%	8.06% <sup>b</sup> (2.04)	-5.27%	-8.76% <sup>a</sup> (-4.01)	16.13%	-4.53% (-1.47)	12.58% <sup>b</sup> (2.51)

**Table 5.16: Three-Year Post-Issue BHAR of SEOs versus Aggregate Liquidity**

This table presents the three-year post-issue equal weighted (in Panel A and C) and value weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of SEO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel present BHAR using the S&P 500, CRSP value-weighted index, and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 36 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_i,T} = \prod_{t=1}^T (1 + R_{p_i,t}) - 1$  for benchmark index, or as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{jt}^{p_i}/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{jt}^{p_i}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_{i,T} = \sum_{i=1}^{N_T} \omega_i (BHR_{i,T} - BHR_{p_i,T})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5856 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences	
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)	
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>) and Equal-Weighted BHAR</b>														
S&P 500 index ( $t$ -statistic)	25.82%	-10.41% <sup>a</sup> (-6.40)	10.20%	-2.92% <sup>a</sup> (-0.84)	25.94%	-19.40% <sup>a</sup> (-8.80)	43.15%	-0.93% <sup>a</sup> (-0.29)	43.15%	-12.77% <sup>a</sup> (-4.12)	43.15%	-10.31% <sup>b</sup> (-2.25)	-1.99% <sup>a</sup> (-0.42)	
CRSP VW index ( $t$ -statistic)	25.82%	-18.81% <sup>a</sup> (-11.74)	10.20%	-11.21% <sup>a</sup> (-3.24)	25.94%	-26.12% <sup>a</sup> (-12.04)	43.15%	-12.77% <sup>a</sup> (-4.12)	43.15%	-20.80% <sup>a</sup> (-7.18)	43.15%	-11.15% <sup>b</sup> (-2.43)	1.56% <sup>a</sup> (0.34)	
CRSP EW index ( $t$ -statistic)	25.82%	-20.87% <sup>a</sup> (-13.26)	10.20%	-31.11% <sup>a</sup> (-8.99)	25.94%	-15.13% <sup>a</sup> (-7.18)	43.15%	-20.80% <sup>a</sup> (-6.88)	43.15%	-4.66% <sup>a</sup> (-1.52)	43.15%	-10.31% <sup>b</sup> (-2.25)	-10.31% <sup>b</sup> (-2.25)	
Size and Book-to-Market ( $t$ -statistic) (5856 obs)	25.92%	-9.24% <sup>a</sup> (-5.78)	9.28%	-15.80% <sup>a</sup> (-4.64)	26.73%	-7.77% <sup>a</sup> (-3.55)	43.25%	-4.66% <sup>a</sup> (-1.52)	43.25%	-4.66% <sup>a</sup> (-1.52)	43.25%	-4.66% <sup>a</sup> (-1.52)	-4.66% <sup>a</sup> (-1.52)	

(continued)

Table 5.16—Continued

Benchmarks	All			High Liquidity		Medium Liquidity		Low Liquidity		Differences
	Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)
	Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR									
S&P 500 index ( <i>t</i> -statistic)	19.83%	-2.16% (-0.89)	-9.78%	-8.21% <sup>b</sup> (-1.97)	31.52%	-7.62% <sup>a</sup> (-2.80)	60.80%	18.33% <sup>a</sup> (3.13)	-26.54% <sup>a</sup> (-3.69)	
CRSP VW index ( <i>t</i> -statistic)	19.83%	-12.35% <sup>a</sup> (-4.81)	-9.78%	-17.86% <sup>a</sup> (-3.62)	31.52%	-15.18% <sup>a</sup> (-5.27)	60.80%	2.99% (0.70)	-20.84% <sup>a</sup> (-3.19)	
CRSP EW index ( <i>t</i> -statistic)	19.83%	-30.42% <sup>a</sup> (-7.55)	-9.78%	-52.59% <sup>a</sup> (-6.38)	31.52%	-11.64% <sup>a</sup> (-3.74)	60.80%	-15.15% <sup>b</sup> (-2.49)	-37.40% <sup>a</sup> (-3.65)	
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	19.99%	-12.86% <sup>a</sup> (-5.35)	-9.87%	-19.62% <sup>a</sup> (-4.67)	31.53%	-14.08% <sup>a</sup> (-3.90)	62.30%	2.68% (0.66)	-22.29% <sup>a</sup> (-3.81)	
Panel C: Liquidity Supply ( <i>Debt/GDP</i> ) and Equal-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	25.82%	-10.41% <sup>a</sup> (-6.40)	24.24%	-24.77% <sup>a</sup> (-9.53)	21.06%	-3.36% (-1.56)	48.93%	23.54% <sup>a</sup> (4.92)	-48.32% <sup>a</sup> (-8.88)	
CRSP VW index ( <i>t</i> -statistic)	25.82%	-18.81% <sup>a</sup> (-11.74)	24.24%	-28.17% <sup>a</sup> (-10.95)	21.06%	-13.88% <sup>a</sup> (-6.52)	48.93%	2.19% (0.46)	-30.36% <sup>a</sup> (-5.65)	
CRSP EW index ( <i>t</i> -statistic)	25.82%	-20.87% <sup>a</sup> (-13.26)	24.24%	-20.48% <sup>a</sup> (-8.12)	21.06%	-19.07% <sup>a</sup> (-9.02)	48.93%	-28.81% <sup>a</sup> (-6.16)	8.33% (1.57)	
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	25.92%	-9.24% <sup>a</sup> (-5.78)	24.53%	-10.18% <sup>a</sup> (-3.98)	20.94%	-9.44% <sup>a</sup> (-4.47)	48.73%	-4.65% (-0.97)	-5.53% (-1.02)	
Panel D: Liquidity Supply ( <i>Debt/GDP</i> ) and Value-Weighted BHAR										
S&P 500 index ( <i>t</i> -statistic)	19.83%	-2.16% (-0.89)	20.06%	-7.87% <sup>c</sup> (-1.85)	9.39%	-5.84% <sup>b</sup> (-2.00)	50.10%	23.49% <sup>a</sup> (3.15)	-31.36% <sup>a</sup> (-3.65)	
CRSP VW index ( <i>t</i> -statistic)	19.83%	-12.35% <sup>a</sup> (-4.81)	20.06%	-12.28% <sup>a</sup> (-3.00)	9.39%	-17.26% <sup>a</sup> (-4.15)	50.10%	2.02% (0.47)	-14.30% <sup>b</sup> (-2.41)	
CRSP EW index ( <i>t</i> -statistic)	19.83%	-30.42% <sup>a</sup> (-7.55)	20.06%	-20.72% <sup>a</sup> (-5.12)	9.39%	-37.73% <sup>a</sup> (-5.20)	50.10%	-33.80% <sup>a</sup> (-3.05)	13.00% (1.11)	
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	19.99%	-12.86% <sup>a</sup> (-5.35)	20.19%	-8.37% <sup>b</sup> (-2.31)	9.48%	-20.66% <sup>a</sup> (-5.16)	50.60%	-1.47% (-0.34)	-6.90% (-1.22)	

**Table 5.17: Five-Year Post-Issue BHAR of SEOs versus Aggregate Liquidity**

This table presents the five-year post-issue equal-weighted (in Panel A and C) and value-weighted (in Panel B and D) buy-and-hold abnormal returns (BHAR) of SEO sample compared with alternative benchmarks, and across various aggregate liquidity portfolios. The sample of SEOs consists of 6,100 SEOs by U.S. firms subsequently listed on AMEX, NYSE, or Nasdaq from 1972 to 2004, excluding units, offers without primary shares, issues by closed-end funds, unit investment trusts, REITs, ADRs, and utilities. SEOs announced in next year of  $(t + 1)$  the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) and aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the corresponding low (or high) liquidity demand portfolios and liquidity supply portfolios, respectively. Row 1 to 6 of each panel present BHAR using the S&P 500, CRSP value-weighted index, and CRSP equal-weighted index as benchmarks. Row 7 to 8 of each panel presents BHAR measured relative to size and book-to-market portfolios (25, 5\*5). To calculate BHAR, I first calculate the 60 months buy-and-hold returns (BHR) for each firm starting in the month following the IPO:  $BHR_{i,T} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  return on firm  $i$ , and  $T$  is the horizon over which BHR is computed. If the IPO delists before the first anniversary, I compound the return up until the delisting. Then I compute the BHR as  $BHR_{p_i,T} = \prod_{t=1}^T (1 + R_{p_i,t}) - 1$  for benchmark index, or as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{n_{it}} R_{j,t}^{p_i}/n_{it}] - 1$  for size and book-to-market matched portfolios, where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $n_{it}$  is the number of firms in the reference portfolio of the event firm  $i$  in month  $t$ , and  $R_{j,t}^{p_i}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$ . The BHAR are then calculated as  $BHAR_{i,T} = \sum_{i=1}^{N_T} \omega_i (BHR_{i,T} - BHR_{p_i,T})$ . When equal weighted  $\omega_i = 1/N_T$  and when value weighted  $\omega_i = MV_i/MV$ , where  $MV_i$  is the firm  $i$ 's common stock market value (in 2004 dollars by CPI) and  $MV = \sum_i MV_i$ .  $N_T$  is the number of event firms that have BHRs for event period. Since some firms lack the accounting information necessary for the attribute matching, I report results for 5,856 firms for size and book-to-market benchmark. The differentials between high liquidity portfolios and low liquidity portfolios for each category are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are reported in parentheses. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences	
	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	Raw IPO Return	Abnormal BHAR	(High -Low)	
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>) and Equal-Weighted BHAR</b>														
S&P 500 index ( $t$ -statistic)	53.87%	-5.26% <sup>c</sup> (-1.65)	23.72%	9.53% <sup>b</sup> (2.39)	47.55%	-25.03% <sup>a</sup> (-6.09)	100.40%	17.52% <sup>c</sup> (1.92)					-7.99% (-0.80)	
CRSP VW index ( $t$ -statistic)	53.87%	-20.83% <sup>a</sup> (-6.58)	23.72%	-5.08% (-1.29)	47.55%	-36.96% <sup>a</sup> (-9.04)	100.40%	-6.39% (-0.70)					1.31% (0.13)	
CRSP EW index ( $t$ -statistic)	53.87%	-25.74% <sup>a</sup> (-8.10)	23.72%	-50.95% <sup>a</sup> (-12.79)	47.55%	-16.59% <sup>a</sup> (-4.07)	100.40%	-15.63% <sup>c</sup> (-1.70)					-35.30% <sup>a</sup> (-3.52)	
Size and Book-to-Market ( $t$ -statistic) (5856 obs)	54.30%	-7.66% <sup>b</sup> (-2.34)	22.10%	-23.86% <sup>a</sup> (-6.20)	49.24%	-5.98% (-1.40)	100.79%	7.48% (0.79)					-31.30% <sup>a</sup> (-3.05)	

(continued)

Table 5.17—Continued

Benchmarks	All			High Liquidity			Medium Liquidity			Low Liquidity			Differences (High -Low)
	Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		Raw IPO Return	Abnormal BHAR		
	Panel B: Liquidity Demand ( $\Delta L/S$ ) and Value-Weighted BHAR												
S&P 500 index ( <i>t</i> -statistic)	50.79%	6.89% <sup>b</sup> (2.06)	6.03%	63.33%	0.54% (0.11)	-1.99% (-0.44)	120.70%	33.23% <sup>a</sup> (3.50)	-32.70% <sup>a</sup> (-3.08)				
CRSP VW index ( <i>t</i> -statistic)	50.79%	-12.27% <sup>a</sup> (-3.60)	6.03%	63.33%	-17.43% <sup>a</sup> (-3.39)	-15.68% <sup>a</sup> (-3.52)	120.70%	3.28% (0.35)	-20.70% <sup>c</sup> (-1.95)				
CRSP EW index ( <i>t</i> -statistic)	50.79%	-45.78% <sup>a</sup> (-6.03)	6.03%	63.33%	-89.60% <sup>a</sup> (-6.71)	-7.79% (-1.30)	120.70%	-17.00% (-0.88)	-72.60% <sup>a</sup> (-3.08)				
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	50.89%	-14.95% <sup>a</sup> (-4.28)	6.07%	63.53%	-24.61% <sup>a</sup> (-5.08)	-13.36% <sup>a</sup> (-2.65)	121.70%	2.07% (0.21)	-26.70% <sup>b</sup> (-2.42)				
Panel C: Liquidity Supply ( <i>Debt/GDP</i> ) and Equal-Weighted BHAR													
S&P 500 index ( <i>t</i> -statistic)	53.87%	-5.26% <sup>c</sup> (-1.65)	59.96%	39.98%	-14.52% <sup>b</sup> (-2.49)	-0.68% (-0.20)	77.70%	16.51% <sup>b</sup> (2.56)	-31.03% <sup>a</sup> (-3.57)				
CRSP VW index ( <i>t</i> -statistic)	53.87%	-20.83% <sup>a</sup> (-6.58)	59.96%	39.98%	-22.12% <sup>a</sup> (-3.80)	-18.33% <sup>a</sup> (-5.56)	77.70%	-24.29% <sup>a</sup> (-3.83)	2.17% (0.25)				
CRSP EW index ( <i>t</i> -statistic)	53.87%	-25.74% <sup>a</sup> (-8.10)	59.96%	39.98%	-19.79% <sup>a</sup> (-3.39)	-20.92% <sup>a</sup> (-6.32)	77.70%	-66.95% <sup>a</sup> (-10.50)	47.16% <sup>a</sup> (5.46)				
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	54.30%	-7.66% <sup>b</sup> (-2.34)	60.23%	40.39%	-1.99% (-0.33)	-9.47% <sup>a</sup> (-2.85)	77.15%	-25.10% <sup>a</sup> (-3.92)	23.12% <sup>a</sup> (2.64)				
Panel D: Liquidity Supply ( <i>Debt/GDP</i> ) and Value-Weighted BHAR													
S&P 500 index ( <i>t</i> -statistic)	50.79%	6.89% <sup>b</sup> (2.06)	54.15%	31.65%	4.41% (0.67)	1.67% (0.46)	98.80%	28.76% <sup>a</sup> (3.35)	-24.30% <sup>b</sup> (-2.25)				
CRSP VW index ( <i>t</i> -statistic)	50.79%	-12.27% <sup>a</sup> (-3.60)	54.15%	31.65%	-5.50% (-0.88)	-17.26% <sup>a</sup> (-4.04)	98.80%	-14.95% <sup>c</sup> (-1.69)	9.50% (0.87)				
CRSP EW index ( <i>t</i> -statistic)	50.79%	-45.78% <sup>a</sup> (-6.03)	54.15%	31.65%	-36.98% <sup>a</sup> (-3.71)	-42.24% <sup>a</sup> (-5.03)	98.80%	-79.00% <sup>b</sup> (-2.30)	42.00% (1.17)				
Size and Book-to-Market ( <i>t</i> -statistic) (5856 obs)	50.89%	-14.95% <sup>a</sup> (-4.28)	54.22%	31.41%	-4.18% (-0.68)	-22.73% <sup>a</sup> (-5.67)	100.00%	-20.00% <sup>c</sup> (-1.77)	15.80% (1.23)				

portfolios, which is shown in Panel A of Table 5.16. The corresponding differences increase to  $-31.30$  and  $-26.70\%$  for the five-year post-issue periods, respectively. Although the degree of underperformance and the high and low differentials vary according to the length of post-issue period, the benchmark returns, and the measurement methods, the majority supports the existence of positive correlation between aggregate liquidity and post-issue underperformance of SEOs.<sup>10</sup>

Similar to early findings on IPO underpricing and SEO discounting, the results for SEO sample appear to be weaker compared with the IPO results. In the literature of public equity offerings, the discounting and underperformance of SEO are smaller related to that of IPO. For those firms listed on exchange issuing additional securities, their performances are subjected to more strict monitoring and their information is available to public investors more easily. SEO by public firms therefore should suffer less information asymmetric, and, consequently, less SEO discounting and long-term underperformance than IPO firms. Thus, when the SEO sample is partitioned by aggregate liquidity factors, the differentials in performance are smaller compared with IPO sample. Consistent with previous studies, the variations of SEO anomalies are relatively smaller throughout different time periods.

## 5.5 Summary and Conclusion

While fully recognising the achievements of prior research in explaining abnormal phenomena in association with public equity offerings, this research intends to explore whether aggregate liquidity factors can explain the observed abnormal phenomena with IPO and SEO samples. Motivated by prior studies in this trend of research and the importance of aggregate liquidity, I question whether IPOs and SEOs announced in high aggregate liquidity periods are fundamentally different from those that occur

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<sup>10</sup>Previous studies already suggested that the magnitudes of IPO and SEO underperformance are significantly affected by empirical methodology. See Brav, Geczy, and Gompers (2000) and Eckbo, Masulis, and Norli (2000), and Gompers and Lerner (2003).

in low aggregate liquidity periods.

Based on the empirical evidence, I can hereby conclude that they are. I examine the activity, underpricing, and long-run BHAR of equity offerings initiated when aggregate liquidity is high (high-liquidity markets) and when they are low (low-liquidity market). The main findings are summarised as follows: First, ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ) both have a positive correlation with the volume of equity issuing, measured in the number and gross proceeds of offerings. This positive correlation remains obvious and significant after controlling exchange listing and value of proceeds. The findings for the sample of IPOs are closely related to the documented positive correlation between firms' capital demand and IPO volume in Lowry (2003).

Second, aggregate liquidity factors also show a strong positive correlation with IPO underpricing and SEO discounting. I have used underpricing (discounting), first-month returns, and the amount of money left on the table for the sample of IPOs (SEOs). The positive differences in these measures between high- and low-liquidity markets suggest that IPOs (SEOs) occurring in high-liquidity periods have greater underpricing problems. These results further support the explanation abilities of aggregate liquidity on IPO (SEO) activity, since the volume and underpricing of IPO (SEO) are positively correlated (see Yung, Çolak, and Wang (2008)). Therefore, aggregate liquidity should have a positive correlation with volume and underpricing.

Third, in addition to the activity and underpricing of equity issues, ACLD ( $\Delta L/S$ ) and AMLS ( $Debt/GDP$ ) both show a strong correlation with long-run post-issue abnormal returns, measured by buy-and-hold abnormal returns. More importantly, the post-issue returns are only "abnormal" for those IPOs (SEOs) announced in high aggregate liquidity markets. Issuing firms going public in low aggregate liquidity environment events have positive long-term abnormal returns. Therefore, the commonly documented underperformance of IPO and SEO actually is driven by some deals initiated in certain periods instead of a widely phenomenon for public



equity issuances. In additions, these results suggest the existence of a “window of opportunity”. Rather than identifying these windows with volume of equity offerings, I find that aggregate liquidity factors offer a stronger identifier at macro level.

## Chapter 6

# The Influence of Aggregate Liquidity on Asset Sales

### 6.1 Introduction

In the U.S., there is a large and active market for corporate assets; the amount of mergers, acquisitions, and asset sales in the overall markets increase substantially through time. While academic research into corporate takeovers has attracted a substantial amount of attention, far less is known about corporate asset sales. Early empirical studies show that the announcements of asset sales are associated with positive stock returns.<sup>1</sup> Many studies in asset sales investigate the motives behind these transactions and suggest that firms divest assets to increase efficiency, focus by reducing their degree of diversification, or have their assets operated by other more efficient firms.<sup>2</sup>

A stream of research in the literature of asset sales reveals the importance of asset sales for the purpose of financing (see Shleifer and Vishny (1992) and Lang, Poulsen,

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<sup>1</sup>For studies on valuation effects, see Alexander, Benson, and Kampmeyer (1984), Jain (1985) and Hite, Owers, and Rogers (1987).

<sup>2</sup>For the focusing explanation, see John and Ofek (1995) and Berger and Ofek (1999). For the efficiency explanation, see Hite, Owers, and Rogers (1987) and Maksimovic and Phillips (2001).

and Stulz (1995)). In fact, unlike other divestiture methods, corporate divesting firms typically receive payment at the effective date of a sale, with a substantial part of this in cash. The average cash compensation is about 92% of the transaction value in asset sales announced between 1985 and 2004.<sup>3</sup> By examining market reactions in association with the use of proceeds from asset sales, evidence shows that markets react favourably to firms undertaking asset sales, but only when the firms plan to retain proceeds (Bates (2005)) or payout proceeds (Lang, Poulsen, and Stulz (1995)). Moreover, in relation to capital liquidity, Schlingemann, Stulz, and Walkling (2002) show that industry-specific asset liquidity is important in determining whether, and which, assets will be divested. Therefore, the liquidity consideration certainly plays an important role in the decision making process involving corporate asset sales.

Given the existence of market anomalies associated with asset sales and the importance of liquidity consideration in decision making, the chapter takes the next logical step by investigating the influence of aggregate liquidity on the activity and performance of divesting firms. Considering the universal need to hoard liquid assets, I observe that aggregate liquidity express cyclical variations. Similarly, such fluctuations are also found in the aggregate activity of asset sales and divesting firm performance. As an important macro factor, aggregate liquidity should carry potentially important implications on corporate divestitures. The purpose of this chapter is, therefore, to explore whether aggregate liquidity factors can explain the variations in asset sales markets and the relative valuation phenomena associated with asset sales. In particular, I want to investigate whether there are fundamental differences between the quality and performance of divestitures undertaken during high aggregate liquidity periods and those occurring in low aggregate liquidity periods.

In this study, I use a sample of 2,793 asset sales, each with a transaction value in excess of \$1 million to divesting firms, announced between January 1, 1985 and De-

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<sup>3</sup>This result is based on the sample of asset sales used in this chapter. Bates (2005) shows that the fraction paid in cash is 95% for a sample of subsidiary sales between 1990 and 1998.

cember 31, 2004. The measures of aggregate liquidity consist of aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS). In order to measure the ACLD, following the methodology in Greenwood (2005), I use data reported in the Federal Reserve's *Flow of Funds* to construct a measure of aggregate corporate accumulation of liquid assets as a fraction of total corporate investment spending. For AMLS, I follow Krishnamurthy and Vissing-Jorgensen (2008) and use the U.S. *Debt/GDP* ratio. The sample of asset sales is partitioned into high-, medium-, and low-liquidity asset sales based on the aggregate liquidity the year before the announcement of the asset sales. Divesting firms in the sample are defined as high-, medium- and low-liquidity divesting firms accordingly.

The major results suggest the following points. First, more asset sales are undertaken during high-liquidity periods, and with larger relative transaction size. Second, divesting firms selling assets in high-liquidity periods have stronger short-term and long-term growth opportunities, measured by asset growth and market-to-book ratios, than divesting firms in low-liquidity periods. Third, high-liquidity divesting firms have a positive and larger BHAR over the three years after asset sales than low-liquidity divesting firms, which experience negative post-sale performance. Although many evidences are realised for the influences of aggregate liquidity on asset sales, some empirical results are relatively unclear. Results on short-term announcement effects show that the shareholders of divesting firms have significant and positive abnormal returns over the three-day interval around the announcement day of asset sales. However, the differences in return between high- and low-liquidity portfolios are inconsistent. The results from a multivariate analysis show signs of the correlation between liquidity and performance of divesting firms after controlling other factors; however, most of the coefficients in regression are statistically insignificant.

Overall, empirical results suggest some correlations between aggregate liquidity and asset sales, and seem to favour the financing explanation. Divesting firms in high aggregate liquidity periods have better investment opportunities and experi-

ence positive post-sale performance in the long-term. In line with previous evidence in Lang, Poulsen, and Stulz (1995) and Bates (2005), the results in this research suggest that high-liquidity asset sales are more likely to be in the interests of shareholders, which consequently lead to more favourable market reactions. In addition, the variation of asset sales in association with aggregate liquidity is less than those of acquisitions and issuances.<sup>4</sup> Because the decisions on corporate divestitures are less likely to be made based on taking advantage of business cycle,<sup>5</sup> the activity of asset sales express weaker co-movement with macro economic factors such as aggregate liquidity.

The chapter explicitly examines the influence of aggregate liquidity on the performance of asset sales measured by firm characteristics and stock returns. It contributes to previous studies in the path of discovering the motivations for asset sales by exploring liquidity factors at aggregate level. The fluctuation of asset sales and the variation of divesting firms' performance have been largely overlooked. Furthermore, the analyses of aggregate liquidity and asset sales also provide supplementary evidences, from different angles, for previous findings in M&A and equity issuances. Corporate asset sales are investigated because of their unique relations with both M&A and equity issuances. Divesting firms in asset sales are similar to target firms in acquisitions. The major difference is that divesting firms remain controls of the company after corporate divestitures. In terms of corporate external financing, asset sales are an alternative path for firms to raise funds in capital markets other than IPOs and SEOs. In equity issuances, firms sell securities (equity or bond) to outside investors to obtain funds, while firms sell subsidiary assets (company divisions, plants) to obtain capital. Therefore, the sample of asset sales allows us to have further understandings of the importance of aggregate liquidity on corporate

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<sup>4</sup>See Chapter 4 and 5 for evidences on acquisitions and public equity issuances, respectively.

<sup>5</sup>For studies on the motivations for asset sales, see, for example, Hite, Owers, and Rogers (1987), Brown, James, and Mooradian (1994), John and Ofek (1995) Lang, Poulsen, and Stulz (1995), Maksimovic and Phillips (2001), and Bates (2005).

decisions.

The remainder of this chapter is organised as follows. Section 6.2 describes the data and Section 6.3 discusses the empirical methodology. Section 6.4 presents the results. Finally, Section 6.5 concludes this chapter.

## 6.2 Data

This section describes the sample of asset sales (in Section 6.2.1) and provides summary statistics for the sample (in Section 6.2.2).

### 6.2.1 Sample Selection

The data on asset sales is obtained from the Thomson One Banker Mergers and Acquisitions (M&A) Database, which contains information on the sales of operating units by firms. This database is exactly the same as the Securities Data Corporation (SDC) Mergers and Acquisitions (M&A) Database, and both databases are maintained by Thomson Financial Services.<sup>6</sup> With this in mind, I will refer to this database as the ‘SDC’ in the following discussion. In the SDC, each transaction is categorized as one of the ten different forms of deal.<sup>7</sup> Since I only require asset sales transactions, the sample of asset sales in this chapter consists of deals listed in the categories of ‘Acquisition of Assets’ and ‘Acquisition of Certain Assets’. Stock returns data and accounting information for divesting firms are collected from the Center for Research in Security Prices (CRSP) and Compustat fundamental annual files, respectively.

The sample consists of successful (completed) asset sales transactions with announcement date and completed date from the beginning of 1985 to the end of 2004.

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<sup>6</sup>Discussion with Thomson One Banker employee verified that both databases are the same.

<sup>7</sup>The form of deal in the SDC Mergers and Acquisitions database includes: Acquisition, Acquisition of Assets, Acquisition of Certain Assets, Acquisition of Majority Interest, Acquisition of Partial Interest, Acquisition of Remaining Interest, Buyback, Exchange Offer, Merger, and Recapitalisation.

Since the SDC has only very limited coverage of asset sales transactions before 1985, especially for information on deal transaction values, I choose 1985 as the starting point of the sample. Warusawitharana (2008) also choose 1985 as the starting point of his sample when using the SDC database. Ending the sample with completed date before the end of 2004 can ensure all divesting firms have at least three years post-sale data for stock returns. By following previous studies, asset sales have to satisfy the following criteria to be included in the sample:

1. Both divesting firms and acquiring firms are publicly-traded firms listed on U.S. exchanges (following Warusawitharana (2008)).
2. All transactions are subsidiary sales with transaction values over one million U.S. dollars.
3. Divesting firms with SIC codes between 6000 and 6999 (financial services industry), or between 4900 and 4999 (regulated utilities) are excluded (following Schlingemann, Stulz, and Walkling (2002)).
4. Divesting firms that cannot be found in the CRSP and Compustat databases are eliminated.

As discussed previously, asset sales are typical means for firms to raise liquidity or cash, especially when other external sources are hard to reach. Firms selling higher value assets are more likely to be driven by their liquidity demands, since a smaller amount of funds can be easily raised from other sources such as credit lines, bank loans, etc. In order to capture the liquidity raising aspect of asset sales, I eliminate transactions with deal values of less than \$1 million. Divesting firms from financial services and utility industry are also excluded, because their business involves inventories of marketable securities and liquid assets. Furthermore, divesting firms are linked to the CRSP stock files and Compustat fundamental annual files via the CUSIP codes from SDC.

**Table 6.1: Yearly Distribution of Asset Sales Sample**

This table presents the yearly distribution of the sample of asset sale firms. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Transaction characteristics are obtained from SDC. Transaction value is the amount raised from asset sales in millions (2002 purchasing power by using CPI). Fraction paid in cash measures the amount of cash payable at the effective date of the sale divided by the transaction value.

Year	Number	Percent	Mean Transaction (\$ million)	Median Transaction (\$ million)	Fraction paid in Cash
1985	73	2.61%	281.0	153.8	96.9%
1986	85	3.04%	298.0	111.6	97.6%
1987	79	2.83%	178.9	79.2	93.5%
1988	85	3.04%	357.9	74.5	96.3%
1989	99	3.54%	197.7	47.9	91.9%
1990	86	3.08%	99.9	46.1	91.0%
1991	73	2.61%	72.5	15.9	92.3%
1992	115	4.12%	81.7	15.4	91.1%
1993	128	4.58%	163.8	36.5	90.9%
1994	156	5.59%	102.6	26.8	90.3%
1995	171	6.12%	114.1	30.7	91.7%
1996	225	8.06%	152.2	32.1	93.3%
1997	273	9.77%	218.9	42.6	92.4%
1998	241	8.63%	159.3	37.0	92.3%
1999	205	7.34%	269.3	45.4	93.1%
2000	152	5.44%	256.6	49.0	89.0%
2001	168	6.02%	650.1	33.5	92.3%
2002	146	5.23%	109.1	28.2	92.3%
2003	115	4.12%	158.8	37.9	93.5%
2004	118	4.22%	192.2	72.1	96.3%
Total	2,793	100.00%	208.5	40.5	92.6%



The final sample of asset sales after this screening process contains 2,793 asset sell-off transactions, each with a transaction value in excess of \$1 million to divesting firms. Table 6.1 shows the yearly distribution of asset sell-off transactions. The number of asset sales vary from the lowest 73 (in 1985 and 1991) to the highest 273 (in 1997). 1996 to 1999 is a relative boom period for asset sales activity, with about 32% of transactions happening in this period. Column 4 and column 5 show the changes of mean and median transaction value through the years, respectively. All transaction values and the value of cash components are adjusted into 2002 dollars by using the Consumer Price Index (CPI). The average transaction value (\$208.5) is larger than the median transaction value (\$41.1) for the whole sample, which suggests that there are more asset sales with small transaction values. For the whole sample, there are 860 (1,933) deals with an adjusted transaction value over (below) \$100 million, and an average of \$611 (\$30) million. The average amount paid in cash for the whole sample is 92.6%. This high percentage of cash payment is also commonly recorded in the literature. Bates (2005), by using a sample of subsidiary sales over \$75 million, shows that divesting firms receive a substantial cash component (95% on average in his sample) at the effective date of a sale. Officer (2007) also captures a high cash ratio of 94% with his sample of subsidiary sales.

Before continuing to a description of the statistics, some definitions associated with the players in asset sales and some potential errors in the SDC database need to be clarified. In every asset sale deal there are three participants: acquiring firms, target firms, and target firms' parents. Acquiring firms, without doubt, are the companies that buy the assets, subsidiaries, or divisions in transactions. The divesting firms in the above criteria are actually the target firms' parents, that sell their assets, subsidiaries, or divisions in asset sales.<sup>8</sup> In this study, since I only consider subsidiary sales, a target firm will be named as a 'subsidiary of a divesting firm', or an 'asset of

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<sup>8</sup>Some papers may refer to target firms as 'divesting firms' and refer to target firms' parents as 'divesting parents'.

a divesting firm'. In short, divesting firms represent the target firms' parents, which sell-off their subsidiary assets.

The potential for data errors in the SDC has been recognised in the literature. Ljungqvist and Wilhelm (2003) provide a discussion of SDC errors regarding initial public offerings. Warusawitharana (2008), in the area of asset purchases and sales, argues that data errors in the SDC on asset transactions are relatively small and should not materially impact statistical inference. Warusawitharana (2008) finds that the SDC dates are accurate within a business day for 92% of his sample, and 88% of the sample have deal values within 5% of the value reported in the SDC. Since my sample shares the same period and similar criteria as his,<sup>9</sup> I can expect data errors in the sample of asset sales for this chapter to be relatively small as well.

### 6.2.2 Summary of Transactions

Table 6.2 provides a summary of the transactions in the sample of asset sales, delineated by industry classification. I classify the transactions based on divesting firms' industry and acquiring firms' industry separately. The distribution of buyers and sellers in asset sales by industry classification can help to explore the potential illiquidity of assets in certain industries. Shleifer and Vishny (1992) suggest that when a firm in financial distress needs to sell assets, its industry peers are likely to be experiencing problems themselves. Such illiquidity makes assets cheap in bad times. The purpose of Table 6.2 is to provide an initial feeling of the distribution of asset sales by industry classification.

By following the industry classification in Lowry (2003), I separate asset divesting firms and acquiring firms into 14 industries, respectively. The results in Table 6.2 show that the distributions of transactions based on divesting firms' industry are similar to the distributions based on acquiring firms' industry. Based on this, it is

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<sup>9</sup>In Warusawitharana (2008), the sample consists of all buyers and sellers from 1985 to the end of 2005, which are either publicly listed firms or subsidiaries of listed companies.

**Table 6.2: Industry Classification of Asset Sales Sample**

This table presents the descriptive statistics for the samples of asset sales classified by industry. Panel A shows the separation based on divesting firms' industry. Panel B shows the separation based on acquiring firms' industry. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Transaction characteristics are obtained from SDC. Mean (median) transaction values are the average (median) proceeds amount raised from asset sales in millions (2002 purchasing power by using CPI). Fraction paid in cash measures the amount of cash payable at the effective dates of the sale divided by the transaction value.

	Divesting Firms				Acquiring Firms					
	Number	Percent	Mean Tran. (\$ mil)	Median Tran. (\$ mil)	Fraction Paid in Cash	Number	Percent	Mean Tran. (\$ mil)	Median Tran. (\$ mil)	Fraction Paid in Cash
Agriculture, Mining	22	0.79%	119.4	32.3	75.1%	24	0.95%	169.8	54.9	67.7%
Apparel	33	1.19%	64.6	37.6	91.9%	29	1.15%	112.3	36.1	92.7%
Communication, Computer, Electronics	779	28.10%	160.6	29.0	84.3%	817	32.31%	154.0	34.5	84.7%
Construction	29	1.05%	41.2	25.5	82.8%	20	0.79%	89.0	33.4	75.2%
Food	52	1.88%	224.6	74.3	86.7%	60	2.37%	413.4	163.9	87.4%
Healthcare	222	8.01%	131.8	26.4	90.3%	172	6.80%	158.8	28.4	88.1%
Manufacturing	425	15.33%	212.7	55.8	89.5%	358	14.16%	163.3	61.4	90.1%
Oil, Gas	284	10.25%	192.6	55.6	92.4%	254	10.04%	187.5	44.5	91.6%
Printing, Publishing	60	2.16%	294.8	39.8	91.3%	41	1.62%	257.1	89.7	93.6%
Recreation	102	3.68%	209.6	64.2	87.6%	60	2.37%	114.7	39.2	84.5%
Scientific Instruments and Research	217	7.83%	105.3	21.5	82.7%	221	8.74%	130.7	23.2	86.4%
Services	100	3.61%	116.9	29.8	84.7%	110	4.35%	110.3	26.2	83.3%
Trade	241	8.69%	161.0	34.5	87.1%	208	8.22%	153.4	35.6	87.9%
Transportation	206	7.43%	188.8	77.3	90.8%	155	6.13%	248.2	74.4	90.5%

very likely that most of the sales occur between companies within the same industry. For both divesting firms and acquiring firms, most of the transactions come from the communications, computer, and electronics sectors between 1985 and 2004, which take up over 28 and 34 percent of the sample, respectively. The second and third largest groups in the classification for divesting firms are manufacturing (425) and oil and gas (284). Regarding the fraction paid in cash, except for agriculture and mining, most industries have asset sales transactions proceeded with over 85% of cash.

## 6.3 Empirical Methodology

In this research, I examine and compare the performance of divesting firms announced in high-, medium-, and low-liquidity periods by studying the short-run stock return surrounding the announcement, the characteristics of divesting firms, and the long-run post-sale stock performance of acquiring firms. Section 6.3.1 and Section 6.3.2 discuss measures of short-run returns (CAR) and long-run performance (BHAR). Section 6.3.3 describes various firm characteristics commonly used in asset sales literature. Section 6.3.4 explains the empirical design.

### 6.3.1 Announcement Returns

Following the event-study methodology described in Brown and Warner (1985), I use the market-adjusted model to estimate cumulative abnormal returns (CAR) for the three-day  $(-1, +1)$  event window surrounding the announcement of asset sales, and for the twenty-day and forty-day windows before or after announcements (i.g.  $(-20, -1)$ ,  $(-40, -1)$ ,  $(+1, +20)$ ,  $(+1, +40)$ ). The daily abnormal returns for a firm are calculated by deducting the index return from the firm's return:

$$AR_{it} = R_{it} - R_{mt} \quad (6.1)$$

where  $R_{it}$  is firm  $i$ 's daily stock return on date  $t$  and  $R_{mt}$  is the return for the equally-weighted (or value-weighted) CRSP index on date  $t$ . The CAR over event windows is calculated as:

$$CAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N \sum_{t=T_1}^{T_2} AR_{it} \quad (6.2)$$

### 6.3.2 Buy-and-Hold Abnormal Returns

The long-term stock returns of divesting firms are calculated with buy-and-hold abnormal returns (BHAR) as follows:<sup>10</sup>

$$BHAR_{(T_1, T_2)} = \frac{1}{N} \sum_{i=1}^N (BHR_{i, (T_1, T_2)} - BHR_{p_i, (T_1, T_2)}) \quad (6.3)$$

where

$$BHR_{i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} (1 + R_{it}) - 1. \quad (6.4)$$

$$BHR_{p_i, (T_1, T_2)} = \prod_{t=T_1}^{T_2} \left[ 1 + \frac{\sum_{j=1}^{N_t} R_{jt}}{N_t} \right] - 1 \quad (6.5)$$

Note that  $BHR_{i, (T_1, T_2)}$  is the buy-and-hold return (BHR) for firm  $i$  over the period  $T_1$  to  $T_2$ .  $BHR_{p_i, (T_1, T_2)}$  is the BHR for firm  $i$ 's size and book-to-market reference portfolio over the period  $T_1$  to  $T_2$ .  $N$  is the number of firms in the sample.

I calculate the 12-, 24-, and 36-month BHAR of divesting firms after the announcement of asset sales. Size and book-to-market reference portfolios are constructed by following Fama and French (1993). The equally-weighted monthly returns of 25 reference portfolios formed on size and book-to-market ( $5 \times 5$ ) are downloaded from Kenneth French's website. Divesting firms are assigned to 25 reference portfolios using the breakpoints for size and book-to-market.

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<sup>10</sup>This method is supported by Barber and Lyon (1997) and Kothari and Warner (1997) because it represents the value of investing in the average sample firms relative to an appropriate benchmark over the period of interest.

### 6.3.3 Firm Characteristics

Many studies in the literature of asset sales explore firm characteristic factors which might affect corporate divestiture decisions. In this section, I describe some commonly used factors for firm characteristics, especially for those used in asset sales research. Table 6.3 provides a detailed summary of the methods used to construct these firm characteristic variables. In particular, typical firm characteristic factors are considered and classified into categories of size (in Panel A), cash and cash flow (in Panel B), leverage (in Panel C), growth rates (in Panel D), and investment and growth opportunities (in Panel E). These firm characteristics are widely used in research on asset sales with different focuses.<sup>11</sup> The construction methods for these characteristics are chosen by following these major papers.

Data used to construct these firm characteristics is collected from Compustat in WRDS, except for the transaction costs of asset sales, which are obtained from the SDC. Table 6.4 provides descriptive statistics of firm characteristic variables for the sample of asset sales. Column 2 shows the number of firms with valid data. For the whole sample, divesting firms have similar total assets and market value of equity. This section generally discusses why these variables are constructed and used to examine the performance of divesting firms. The characteristics of divesting firms will be examined together with aggregate liquidity measures to explore whether divesting firms selling assets in high-liquidity periods are substantially different from those selling in low-liquidity periods. Such an analysis can determine which type of firms respond to aggregate liquidity more actively and positively.

#### ***A Firm Size***

Firm size is a typical variable used in corporate finance studies. Small and large firms have substantial differences in financing preferences. Firm size is an important

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<sup>11</sup>See, for example, Brown, James, and Mooradian (1994), Lang, Poulsen, and Stulz (1995), Schlingemann, Stulz, and Walkling (2002), and Bates (2005).

**Table 6.3: Summary of Firm Characteristic Variables**

This table presents the summary of firm characteristic variables and data items used to construct them. Firm characteristic variables are classified into five categories: firm size (in Panel A), cash and cash flow (in Panel B), leverage (in Panel C), growth rates (in Panel D), and investment and growth opportunities (in Panel E). Total assets, market value of equity, and sales are expressed in billions of dollar. All accounting data for firm characteristics are collected from COMPUSTAT Fundamental Annual Database. Only transaction values are obtained from SDC.

Variables	Construction Method	Data Items (Name : Label)
<b>Panel A: Size</b>		
Total Assets	Total Assets is the book value of assets in millions of dollars.	AT: Assets - Total
Market Value of Equity	Market Value of Equity is the market value of total common equity. $MVE = CSHO * PRCCF$	PRCCF: Price Close - Annual - Fiscal & CSHO : Common Shares Outstanding
Sales	Sales represent gross sales.	SALE: Sales/Turnover (Net)
Relative Tran. Size	Relative Transaction Size is computed as reported value of the deal transaction by SDC divided by the total assets of the firm one year prior to asset sales or equity issues. $RT = TV/AT$	TV: Transaction Values & AT: Assets - Total
<b>Panel B: Cash and Cash Flow</b>		
Cash/Assets	Cash/Assets is the level of cash and marketable securities held by the firm normalized by total assets. $Cash/Assets = CHE/AT$	CHE: Cash and Short-Term Investments & AT: Assets - Total
Cash Flow/Assets	Cash Flow/Assets is estimated as operating income before depreciation minus interest expense, dividends, and taxes paid, divided by total assets. $CashFlow/Assets = (OIBDP - XINT - DVT - TXT)/AT$ , where $DVT = DVC + DVP$	OIBDP: Operating Income Before Depreciation & XINT: Interest and Related Expense - Total & DVT: Dividends - Total & DVP: Dividends - Preferred/Preference & DVC: Dividends Common/Ordinary & TXT: Income Taxes - Total
<b>Panel C: Leverage</b>		
Debt/Assets	Debt/Assets is the ratio of short-term and long-term debt (total liabilities) to total assets. $Debt/Assets = (DLC + DLTT)/AT$	DLC: Debt in Current Liabilities - Total & DLTT: Long-Term Debt - Total & AT: Assets - Total
Coverage Ratio	Coverage Ratio is calculated as operating income before depreciation, divided by interest expense. $CoverageRatio = OIBDP/XINT$	OIBDP: Operating Income Before Depreciation & XINT: Interest and Related Expense - Total

(continued)

Table 6.3—Continued

Variables	Construction Method	Data Items (Name : Label)
<b>Panel D: Growth Rates</b>		
Sales Growth	Sales Growth is the percentage change in sales. $SG = (Sale_t / Sale_{t-1}) - 1$	SALE: Sales/Turnover (Net)
Assets Growth	Asset Growth is the percentage change in total assets. $AG = (AT_t / AT_{t-1}) - 1$	AT: Assets - Total
<b>Panel E: Investment and Growth Opportunities</b>		
Market-to-Book	Following Fenn and Liang (2001), the market-to-book assets ratio of firms proxies for the extent and quality of investment opportunities. Market-to-book assets ratio is the market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. $MKTtoBOOK = (BVA + MVE - BVE) / BVA = (AT + (CSHO * PRCCF) - CEQ) / AT$	AT: Assets - Total & CEQ: Common/Ordinary Equity - Total & PRCCF : Price Close - Annual - Fiscal & CSHO : Common Shares Outstanding
Capital Investment	Following Bates(2005), growth opportunities is estimated using the capital expenditures—a measure that under rational expectations provides an ex post proxy for anticipated investment. Capital investment is measured as capital expenditures net of sales of property plant and equipment, and scaled by the firm's total assets. $CapitalInvestment = (CAPX - SPPE) / AT$	CAPX: Capital Expenditures & SPPE: Sale of Property & AT: Assets - Total



**Table 6.4: Descriptive Statistics of Firm Characteristics**

This table presents the descriptive statistics for firms in both asset sales and equity issues samples the fiscal year prior to transaction. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2005 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Transaction characteristics are obtained from SDC. The sample firms are lined to Compustat data set using CUSIP numbers, and accounting data are collected from Compustat. Total Assets is the book value of assets in billions of dollars. Market Value of Equity is the market value of total common equity in billions of dollars. Relative transaction size is the market value of the transaction divided by the divesting firm's pre-sale total assets. Cash/Assets is the level of cash and marketable securities held by the firm normalized by total assets. Cash Flow/Assets is estimated as operating income before depreciation minus interest expense, dividends, and taxes paid, divided by total assets. Debt/Assets is the ratio of short-term and long-term debt (total liabilities) to total assets. Coverage Ratio is calculated as operating income before depreciation, divided by interest expense. Sales Growth is the percentage change in sales. Asset Growth is the percentage change in total assets. Market-to-book assets ratio is the market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. Capital investment is measured as capital expenditures net of sales of property plant and equipment, and scaled by the firm's total assets. Total assets, market value of equity, and sales are expressed in billions of dollar.

Variables	Number	Mean	First Quartile	Median	Third Quartile	Standard Deviation
<b>Panel A: Size</b>						
Total Assets	2580	13.452	0.204	1.355	7.881	47.34
Market Value of Equity	2551	11.970	0.130	1.039	6.260	37.00
Sales	2579	8.823	0.198	1.200	6.941	22.09
Relative Transaction	2580	0.167	0.007	0.037	0.157	0.50
<b>Panel B: Cash and Cash Flow</b>						
Cash/Assets	2580	0.106	0.015	0.042	0.126	0.16
Cash Flow/Assets	2559	0.007	0.013	0.055	0.091	0.35
<b>Panel C: Leverage</b>						
Total Debt/Assets	2464	0.326	0.176	0.293	0.424	0.24
Coverage Ratio	2450	13.700	1.800	4.500	9.100	328.60
<b>Panel D: Growth Rates</b>						
Sales Growth	2558	0.174	-0.088	0.040	0.187	1.46
Assets Growth	2565	0.171	-0.079	0.031	0.174	0.85
<b>Panel E: Investment and Growth Opportunities</b>						
Market-to-Book	2547	1.778	1.119	1.416	1.931	1.52
Capital Investment	2533	0.056	0.021	0.045	0.076	0.09

proxy for transaction costs in external financing, as well as for the level of financial constraints. Empirical evidence shows that the transaction costs of new issues decrease with issue size, which makes external funds relatively more expensive for small firms. Moreover, small firms get less monitoring coverage and may have less access to external financing because of adverse selection problems (Myers and Majluf (1984)). Kim, Mauer, and Sherman (1998) contend that larger firms are able to better exploit the scale economies because they raise large amounts of capital frequently. Almeida, Campello, and Weisbach (2004) and Faulkender and Wang (2006) argue that large firms have easier access to capital markets relative to small firms because they face fewer constraints. For financial constraints, Kaplan and Zingales (1997) find that smaller firms face more constraints in accessing external capital markets, and are less likely to be able to exploit the scale economies.

Because asset sales, compared to public offerings, are more like a private external fund financing source, larger firms should have substantial preference over smaller firms. Following previous studies, firm size is defined as the natural log of the book value of assets. For comparison purposes, I also include the market value of equity, sales, and the relative transaction size of asset sales into the size category of firm characteristics. Panel A of Table 6.3 presents the construction methods for each variable and the data items used from Compustat.

## ***B Cash and Cash Flow***

Instead of seeking costly external financing, firms can also finance investments by using internally generated cash flows, or by selling off substitute reserved liquid assets. Therefore, companies with more internal liquid asset reserves or internal cash flow should be less affected by aggregate liquidity to proceed asset sales. Harford (1999) and Officer (2007), in the area of mergers and acquisitions, find that corporate liquidity reserves have substantial effects on corporate financing and investment decisions. Firms with less liquid asset holdings are more likely to raise funds through

subsidiary divestitures. Panel B of Table 6.3 shows two variables for cash and cash flow. Cash/Assets is defined as the level of cash and marketable securities held by the firm, normalised by total assets. Cash Flow/Assets is estimated as operating income before depreciation net of interest expense, dividends, and taxes paid, and then divided by the total assets.

### *C Leverage*

According to Lang, Ofek, and Stulz (1996), leverage may negatively affect firm investment in a number of ways by reducing the amount of cash available for investment. For highly leveraged firms, the requirement for accessing external financing is higher. Therefore, I apply Debt/Assets, which is the ratio of short-term and long-term debt (total liabilities) to total assets (book value of assets), as the measure of leverage.

Bates (2005) finds that, consistent with the disciplinary role of debt, firms in the debt-payout sample have a significantly lower interest coverage and higher debt to asset ratio compared to the firms in the retention sample. Coverage ratio (also known as ‘interest coverage’) is also an important measure for firm financial leverage. Thus, I include coverage ratio as another measure of leverage, which is calculated as operating income before depreciation, divided by interest expense. These two ratios are discussed in Panel C of Table 6.3.

### *D Investment and Growth Opportunities*

As discussed in D’Mello, Krishnaswami, and Larkin (2008), firms with valuable growth opportunities are likely to demand greater funds in the future to finance these investments. These firms are less likely to be able to consistently finance the investments out of operating income, and hence are more likely to access external capital markets. In the literature, many studies use the market-to-book assets ratio as a measure of the extent and quality of growth opportunities, such as Smith and Watts (1992), Fenn and Liang (2001), and Bates (2005). Following these papers, I

define the variable as the ratio of market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. Some papers may consider the market-to-book assets ratio as a measure of long-term growth opportunities. Contrarily, Pinkowitz and Williamson (2005) argue that sales growth and asset growth are measures of immediate investment opportunities. Sales growth and assets growth are defined as the percentage change in sales and assets respectively, which are shown in Panel D of Table 6.3.

Following Bates (2005), investment activity or investment intensity is estimated using the capital expenditures of the divesting firms following the sales. Denis (1994) and Pilotte (1992) also argue that this is a measure that under rational expectations provides an *ex post* proxy for anticipated investment. I define capital investment as capital expenditure net of sales of property, plant, and equipment, and scaled by the firm's total assets. The measures of capital investment and market-to-book asset ratio are discussed in Panel E of Table 6.3.

#### 6.3.4 Aggregate Liquidity and Empirical Design

To examine the influence of aggregate liquidity on asset sales, I split the sample period into high-, medium-, and low-liquidity periods, and compare the performance of divesting firms that announce asset sales under different aggregate liquidity conditions. The measures of aggregate liquidity include aggregate corporate liquidity demand (ACLD),  $\Delta L/S$ , and aggregate market liquidity supply (AMLS),  $Debt/GDP$ . Firstly, I separate the sample period (20 years, 1985 to 2004) into high-liquidity (30%), medium-liquidity (40%), and low-liquidity (40%) periods based on the aggregate liquidity in the prior year. Under this method, there are 6 high-liquidity, 8 medium-liquidity, and 6 low-liquidity years. Secondly, asset sales announced in the high-, medium-, or low-liquidity periods are defined as high-, medium-, or

low-liquidity sales, respectively. To summarise, divesting firms are put into high-, medium-, and low-liquidity portfolios based on the corresponding measures of aggregate liquidity (demand or supply) in the year before the announcement of the asset sales.

## 6.4 Empirical Results

### 6.4.1 Activity and Announcement Effects

The aggregate performance of corporate financing and investment activity has been studied extensively in the literature.<sup>12</sup> However, such an analysis has been missed in asset sales literature. The variation of the amount of asset sales is relatively smaller compared to that of equity offerings and takeovers. Table 6.5 presents the number of asset sales, the transaction values, and the relative transaction sizes for divesting firms. Panel A shows the results of various liquidity demand portfolios. The amount of asset sales is higher (1,002) when aggregate liquidity is highly related to low aggregate liquidity periods (784). The difference between high- and low-liquidity supply portfolios is even larger, about 500, which is shown in Panel B.

When comparing the mean and median values of the transactions, results for the high-low differentials are mixed. Asset sales announced in high-liquidity demand periods have larger transaction values than those undertaken in low-liquidity demand periods. However, for aggregate liquidity supply, the difference becomes negative. Although the differences in relative transaction size are positive for both aggregate liquidity measures, neither of them are statistically significant.

Many studies in the 1980s examined the announcement effects of corporate divestitures (see, e.g., Alexander, Benson, and Kampmeyer (1984), Hite, Owers, and Rogers (1987), Klein (1986), and Rosenfeld (1984)). Without exception, these stud-

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<sup>12</sup>See, for example, Harford (2005) in M&A and Lowry (2003) in IPOs.

**Table 6.5: Asset Sales Activity and Aggregate Liquidity**

This table presents the number of asset sales, the mean (median) transaction values and relative transaction sizes for the divesting firms in the sample. Data are delineated by the aggregate corporate liquidity demand ( $\Delta L/S$ ) or aggregate market liquidity supply ( $Debt/GDP$ ). The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Asset sales announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) or aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios or liquidity supply portfolios, respectively. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Transaction characteristics are obtained from SDC. The sample firms are linked to Compustat data set using CUSIP numbers, and accounting data are collected from Compustat. Relative transaction size is the market value of the transaction divided by the divesting firm's pre-sale total assets. Statistical significant of the mean difference is based on a two-sample  $t$  test and the statistical significant of the median difference is based on a Wilcoxon signed-rank test. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

Variables	Total	High (30%)	Medium (40%)	Low (30%)	Differences	
		Liquidity	Liquidity	Liquidity	(H-L)	p-value
Panel A: Liquidity Demand ( $\Delta L/S$ )						
Number	2,793	1,002	1,007	784		
Transaction	208.5 [40.5]	293.9 [43.4]	155.4 [41.1]	167.7 [37.6]	126.2 [5.8]	0.105 0.049
Relative Tran.	0.167 [0.037]	0.180 [0.038]	0.149 [0.038]	0.173 [0.036]	0.007 [0.002]	0.809 0.719
Panel B: Liquidity Supply ( $Debt/GDP$ )						
Number	2,793	1,194	894	705		
Transaction	208.5 [40.5]	158.2 [33.4]	203.2 [43.5]	301.0 [55.0]	-142.8 [-21.6]	0.181 0.000
Relative Tran.	0.167 [0.037]	0.163 [0.038]	0.190 [0.043]	0.143 [0.031]	0.020 [0.007]	0.279 0.176

**Table 6.6: CAR to Asset Sales and Aggregate Liquidity Demand**

This table presents the divesting firms' cumulative abnormal returns (CAR) within aggregate liquidity portfolios. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP. Asset sales announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios. To calculate CAR, firstly the daily abnormal returns (AR) for each event firm for period ranging from -40 day to +40 day are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the Equal-weighted or Value-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over each event window separately. The differentials between high-liquidity portfolios and low-liquidity portfolios for each event window are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	All Asset Sales	High (30%) Liquidity	Medium (40%) Liquidity	Low (30%) Liquidity	Differences (High-Low)
<b>Panel A: Equal-Weighted CRSP Index</b>					
(-40, -1)	-1.08% <sup>c</sup> (-1.78)	-1.89% <sup>c</sup> (-1.88)	-0.88% (-0.80)	-0.31% (-0.29)	-1.59% (-1.10)
(-20, -1)	-0.26% (-0.62)	-0.80% (-1.12)	0.17% (0.24)	-0.11% (-0.15)	-0.69% (-0.69)
(-1, +1)	1.40% <sup>a</sup> (6.85)	1.09% <sup>a</sup> (2.87)	1.81% <sup>a</sup> (6.18)	1.26% <sup>a</sup> (3.23)	-0.17% (-0.30)
(+1, +20)	-1.33% <sup>a</sup> (-3.86)	-1.43% <sup>b</sup> (-2.10)	-1.21% <sup>b</sup> (-2.56)	-1.34% <sup>b</sup> (-2.19)	-0.09% (-0.10)
(+1, +40)	-1.97% <sup>a</sup> (-4.26)	-1.86% <sup>b</sup> (-2.08)	-1.94% <sup>a</sup> (-3.04)	-2.17% <sup>b</sup> (-2.47)	0.31% (0.25)
<b>Panel B: Value-Weighted CRSP Index</b>					
(-40, -1)	1.05% <sup>c</sup> (1.72)	0.47% (0.46)	1.68% (1.54)	1.02% (0.97)	-0.55% (-0.38)
(-20, -1)	0.84% <sup>b</sup> (2.00)	0.38% (0.52)	1.48% <sup>b</sup> (2.00)	0.63% (0.89)	-0.26% (-0.25)
(-1, +1)	1.55% <sup>a</sup> (7.54)	1.28% <sup>a</sup> (3.32)	2.00% <sup>a</sup> (6.82)	1.31% <sup>a</sup> (3.36)	-0.03% (-0.06)
(+1, +20)	-0.38% (-1.11)	-0.49% (-0.72)	0.05% (0.09)	-0.81% (-1.31)	0.32% (0.35)
(+1, +40)	-0.13% (-0.28)	0.01% (0.01)	0.40% (0.62)	-1.01% (-1.14)	1.02% (0.81)

**Table 6.7: CAR to Asset Sales and Aggregate Liquidity Supply**

This table presents the divesting firms' cumulative abnormal returns (CAR) within aggregate liquidity portfolios. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP. Asset sales announced in the next year ( $t + 1$ ) of the lowest (or highest) 30% aggregate market liquidity supply (*Debt/GDP*) years ( $t$ ) are put into the low (or high) liquidity supply portfolios. To calculate CAR, firstly the daily abnormal returns (AR) for each event firm for period ranging from -40 day to +40 day are calculated:  $AR_{it} = R_{it} - R_{mt}$ , where  $R_{it}$  is firm  $i$ 's stock return on date  $t$  and  $R_{mt}$  is the return for the equal-weighted or value-weighted CRSP index on date  $t$ . Then CAR are calculated by summing the daily AR over each event window separately. The differentials between high-liquidity portfolios and low-liquidity portfolios for each event window are reported, where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively.

Event Windows	All Asset Sales	High (30%) Liquidity	Medium (40%) Liquidity	Low (30%) Liquidity	Differences (High-Low)
<b>Panel A: Equal-Weighted CRSP Index</b>					
(-40, -1)	-1.08% <sup>c</sup> (-1.78)	0.64% (0.81)	-0.47% (-0.49)	-4.71% <sup>a</sup> (-3.00)	5.35% <sup>a</sup> (3.05)
(-20, -1)	-0.26% (-0.62)	0.78% (1.52)	0.30% (0.46)	-2.68% <sup>b</sup> (-2.36)	3.46% <sup>a</sup> (2.77)
(-1, +1)	1.40% <sup>a</sup> (6.85)	1.55% <sup>a</sup> (4.85)	0.96% <sup>a</sup> (2.77)	1.72% <sup>a</sup> (4.22)	-0.16% (-0.32)
(+1, +20)	-1.33% <sup>a</sup> (-3.86)	-1.12% <sup>a</sup> (-2.57)	-2.09% <sup>a</sup> (-2.85)	-0.67% (-1.01)	-0.44% (-0.56)
(+1, +40)	-1.97% <sup>a</sup> (-4.26)	-1.71% <sup>a</sup> (-2.90)	-2.72% <sup>a</sup> (-2.75)	-1.42% (-1.60)	-0.29% (-0.27)
<b>Panel B: Value-Weighted CRSP Index</b>					
(-40, -1)	1.05% <sup>c</sup> (1.72)	2.13% <sup>a</sup> (2.65)	1.57% (1.63)	-1.37% (-0.87)	3.49% <sup>b</sup> (1.98)
(-20, -1)	0.84% <sup>b</sup> (2.00)	1.43% <sup>a</sup> (2.77)	1.45% <sup>b</sup> (2.20)	-0.90% (-0.79)	2.33% <sup>c</sup> (1.87)
(-1, +1)	1.55% <sup>a</sup> (7.54)	1.62% <sup>a</sup> (5.05)	1.11% <sup>a</sup> (3.20)	2.01% <sup>a</sup> (4.87)	-0.39% (-0.75)
(+1, +20)	-0.38% (-1.11)	-0.46% (-1.05)	-0.97% (-1.32)	0.56% (0.84)	-1.02% (-1.28)
(+1, +40)	-0.13% (-0.28)	-0.46% (-0.77)	-0.34% (-0.34)	0.76% (0.86)	-1.22% (-1.15)



ies all found positive and statistically significant abnormal returns surrounding the announcement dates of asset sales. However, evidence for pre-announcement and post-announcement CARs are inconsistent.<sup>13</sup>

Table 6.6 presents the results of abnormal returns to divesting firms for the four months surrounding the announcement date of asset sales. I include both an equally-weighted (EW) and value-weighted (VW) CRSP index to calculate CAR. Consistent with previous findings, the average three-day CARs to divesting firms, the interval around the day of the sale announcement, are 1.40% with the EW CRSP index and 1.55% with the VW CRSP index, which are both statistically significant at 1% level.<sup>14</sup> Moreover, average CAR over the pre-announcement and post-announcement periods show that the shareholders of divesting firms gain positive abnormal returns before the sale announcement and experience negative returns in a post-event period.

The differences in CAR between high- and low-liquidity demand (supply) sales are shown in Table 6.6 (Table 6.7). In general, the pattern of abnormal returns before and after announcements remains, sometimes weakly, across different liquidity portfolios. Divesting firms selling in high-liquidity states slightly underperform against those selling in low-liquidity states over days  $(-1, +1)$ , but the CAR differences are insignificant. For aggregate liquidity supply, I find evidence that high-liquidity divesting firms experience significantly larger returns than low-liquidity firms.

## 6.4.2 Divesting Firm Characteristics

Firm characteristic variables are commonly used in research on asset sales. I consider the typical variables used in Schlingemann, Stulz, and Walkling (2002), Bates (2005), and Warusawitharana (2008), and follow their methods to construct these variables, which include total assets, market value of equity, cash/assets ratio, cash flow/assets

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<sup>13</sup>Table 2.3 in Chapter 2 summarises the findings of these studies.

<sup>14</sup>Recent research by Bates (2005) examines the announcement period of abnormal returns with the market model. He finds the average CAR is 1.20% over  $(-1, +1)$ .

ratio, debt/assets ratio, coverage ratio, sales growth, assets growth, market-to-book ratio, and capital investment.

Table 6.8 reports the results of firm characteristics for divesting firms. Columns 1 to 3 show the value of each variable from the fiscal year before the announcement of asset sales to the fiscal year after this event. The last two columns provide the differences in mean and median values of firm characteristics between year  $(t+1)$  and year  $(t-1)$ . The results are consistent with previous findings in the literature. The size of divesting firms increases over the three years and the increase in total assets is \$3.026 billion. Moreover, the results also show that divesting firms significantly increase their cash ratio from 0.097 to 0.118, and reduce their capital investment from 0.063 to 0.053. It is reasonable to assume that divesting firms accumulate liquidity through sales of assets. Indeed, firms with less holdings of liquid assets are more likely to raise funds through subsidiary divestitures.

Tables 6.9 and 6.10 show the values of firm characteristics across various liquidity demand and liquidity supply portfolios, respectively. By comparing high- and low-liquidity sales, I find significant differences in many variables. Firstly, divesting firms announced in high-liquidity periods are larger in size than low-liquidity divesting firms. The difference in total assets between high- and low-liquidity sales is 7.620, which is significant at 1% level. This large difference in size is also supported by a significant difference in the market value of equity of 8.965. These results are consistent with previous findings of transaction values. As indicated in Table 6.9, high-liquidity divesting firms have smaller leverage, measured by debt-to-asset ratio. The mean and median differences are  $-0.023$  and  $-0.022$ , respectively, and statistically significant.

In the literature, many studies apply the ratios of market-to-book assets as a measure of growth opportunities. The M/B ratio is often considered as the measure of long-term growth opportunities, while assets growth is suggested as the measure of immediate investment opportunities (see Pinkowitz and Williamson (2005)). The

**Table 6.8: Comparison of Firm Characteristics through Time**

This table presents the mean (median) total assets, market value of equity, cash/assets ratio, cash flow/assets ratio, debt/assets ratio, coverage ratio, sales growth, assets growth, market-to-book ratio, and capital investment for the divesting firms in the sample. Data are presented relative to the fiscal year of the announcement date of the sale ( $t$ ). The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Total Assets is the book value of assets in billions of dollars. Market Value of Equity is the market value of total common equity in billions of dollars. Cash/Assets is the level of cash and marketable securities held by the firm normalized by total assets. Cash Flow/Assets is estimated as operating income before depreciation minus interest expense, dividends, and taxes paid, divided by total assets. Debt/Assets is the ratio of short-term and long-term debt (total liabilities) to total assets. Coverage Ratio is calculated as operating income before depreciation, divided by interest expense. Sales Growth is the percentage change in sales. Asset Growth is the percentage change in total assets. Market-to-book assets ratio is the market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. Capital investment is measured as capital expenditures net of sales of property plant and equipment, and scaled by the firm's total assets. Statistical significant of the mean difference is based on a two-sample  $t$  test and the statistical significant of the median difference is based on a Wilcoxon signed-rank test. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

Variables	Year	Year	Year	Differences	
	( $t - 1$ )	( $t$ )	( $t + 1$ )	( $t - 1$ ) to ( $t + 1$ )	$p$ -value
Total Assets	11.994 [1.178]	13.452 [1.355]	15.020 [1.620]	3.026 <sup>b</sup> 0.442 <sup>a</sup>	0.023 0.000
Market Value of Equity	10.900 [0.962]	11.970 [1.039]	13.832 [1.267]	2.932 <sup>a</sup> 0.305 <sup>a</sup>	0.008 0.002
Cash/Assets	0.097 [0.038]	0.106 [0.042]	0.118 [0.047]	0.021 <sup>a</sup> 0.009 <sup>a</sup>	0.000 0.000
Cash Flow/Assets	0.026 [0.059]	0.007 [0.055]	0.009 [0.056]	-0.016 <sup>c</sup> -0.003 <sup>c</sup>	0.051 0.082
Debt/Assets	0.325 [0.292]	0.326 [0.293]	0.324 [0.285]	-0.001 -0.007	0.928 0.235
Coverage Ratio	22.100 [4.900]	13.700 [4.500]	10.580 [4.750]	-11.520 -0.150	0.185 0.528
Sales Growth	0.594 [0.075]	0.174 [0.040]	0.252 [0.046]	-0.342 -0.029 <sup>a</sup>	0.166 0.000
Assets Growth	1.530 [0.070]	0.171 [0.031]	0.274 [0.017]	-1.256 -0.053 <sup>a</sup>	0.129 0.000
Market-to-Book	1.758 [1.393]	1.778 [1.416]	1.843 [1.437]	0.085 0.044 <sup>c</sup>	0.263 0.082
Capital Investment	0.063 [0.050]	0.056 [0.045]	0.053 [0.041]	-0.011 <sup>a</sup> -0.008 <sup>a</sup>	0.000 0.000

**Table 6.9: Characteristics of Divesting Firms and Aggregate Liquidity Demand**

This table presents the mean (median) values of the following variables for divesting firms in the sample. Data are delineated by the aggregate corporate liquidity demand ( $\Delta L/S$ ). The asset sales sample consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP. Total Assets is the book value of assets in billions of dollars. Market Value of Equity is the market value of total common equity in billions of dollars. Cash/Assets is the level of cash and marketable securities held by the firm normalized by total assets. Cash Flow/Assets is estimated as operating income before depreciation minus interest expense, dividends, and taxes paid, divided by total assets. Debt/Assets is the ratio of short-term and long-term debt (total liabilities) to total assets. Coverage Ratio is calculated as operating income before depreciation, divided by interest expense. Sales Growth is the percentage change in sales. Asset Growth is the percentage change in total assets. Market-to-book assets ratio is the market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. Capital investment is measured as capital expenditures net of sales of property plant and equipment, and scaled by the firm's total assets. Statistical significant of the mean difference is based on a two-sample  $t$  test and the statistical significant of the median difference is based on a Wilcoxon signed-rank test. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

	All Asset Sales	High (30%)		Medium (40%)		Low (30%)		Differences	
		Liquidity		Liquidity		Liquidity		(High-Low)	$p$ -value
Total Assets	13.452 [1.355]	18.040 [1.540]		11.370 [1.280]		10.420 [1.240]		7.620 <sup>a</sup> 0.300 <sup>c</sup>	0.001 0.070
Market Value of Equity	11.970 [1.039]	18.180 [1.410]		8.097 [0.907]		9.215 [0.857]		8.965 <sup>a</sup> 0.553 <sup>a</sup>	0.000 0.000
Cash/Assets	0.106 [0.042]	0.119 [0.044]		0.096 [0.043]		0.100 [0.039]		0.019 <sup>b</sup> 0.004	0.017 0.467
Cash Flow/Assets	0.007 [0.055]	-0.017 [0.054]		0.018 [0.054]		0.024 [0.057]		-0.040 <sup>b</sup> -0.003	0.036 0.912
Debt/Assets	0.326 [0.293]	0.314 [0.283]		0.327 [0.299]		0.337 [0.306]		-0.023 <sup>c</sup> -0.022 <sup>b</sup>	0.064 0.017
Coverage Ratio	13.700 [4.500]	8.020 [4.890]		23.200 [4.300]		8.490 [4.290]		-0.470 0.600	0.945 0.241
Sales Growth	0.174 [0.040]	0.244 [0.056]		0.072 [0.011]		0.222 [0.056]		0.022 0.000	0.816 0.139
Assets Growth	0.171 [0.031]	0.259 [0.054]		0.106 [0.016]		0.144 [0.031]		0.115 <sup>b</sup> 0.022 <sup>a</sup>	0.012 0.009
Market-to-Book	1.778 [1.416]	2.034 [1.575]		1.604 [1.370]		1.682 [1.362]		0.352 <sup>a</sup> 0.213 <sup>a</sup>	0.000 0.000
Capital Investment	0.056 [0.045]	0.057 [0.046]		0.058 [0.045]		0.053 [0.046]		0.004 0.000	0.398 0.632

Table 6.10: Characteristics of Divesting Firms and Aggregate Liquidity Supply

This table presents the mean (median) values of the following variables for divesting firms in the sample. Data are delineated by the aggregate market liquidity supply (*Debt/GDP*). The asset sales sample consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP. Total Assets is the book value of assets in billions of dollars. Market Value of Equity is the market value of total common equity in billions of dollars. Cash/Assets is the level of cash and marketable securities held by the firm normalized by total assets. Cash Flow/Assets is estimated as operating income before depreciation minus interest expense, dividends, and taxes paid, divided by total assets. Debt/Assets is the ratio of short-term and long-term debt (total liabilities) to total assets. Coverage Ratio is calculated as operating income before depreciation, divided by interest expense. Sales Growth is the percentage change in sales. Asset Growth is the percentage change in total assets. Market-to-book assets ratio is the market value of assets divided by the book value of assets, where the market value of assets is the book value of assets plus the market value of equity minus the book value of equity. Capital investment is measured as capital expenditures net of sales of property plant and equipment, and scaled by the firm's total assets. Statistical significant of the mean difference is based on a two-sample *t* test and the statistical significant of the median difference is based on a Wilcoxon signed-rank test. Superscripts *a*, *b*, and *c* indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

	All Asset Sales	High (30%)		Medium (40%)		Low (30%)		Differences	
		Liquidity		Liquidity		Liquidity		(High-Low)	<i>p</i> -value
Total Assets	13.452 [1.355]	11.220 [1.140]		11.540 [1.330]		19.980 [2.320]		-8.760 <sup>a</sup> -1.180 <sup>a</sup>	0.004 0.000
Market Value of Equity	11.970 [1.039]	9.928 [1.080]		11.440 [0.810]		16.310 [1.530]		-6.382 <sup>a</sup> -0.450	0.002 0.332
Cash/Assets	0.106 [0.042]	0.099 [0.036]		0.094 [0.038]		0.132 [0.061]		-0.032 <sup>a</sup> -0.025 <sup>a</sup>	0.000 0.000
Cash Flow/Assets	0.007 [0.055]	0.028 [0.064]		-0.001 [0.048]		-0.018 [0.048]		0.046 <sup>a</sup> 0.016 <sup>a</sup>	0.003 0.000
Debt/Assets	0.326 [0.293]	0.320 [0.293]		0.338 [0.307]		0.320 [0.282]		0.000 0.011	0.984 0.192
Coverage Ratio	13.700 [4.500]	29.700 [5.200]		6.250 [3.890]		-5.190 [4.120]		34.890 <sup>b</sup> 1.080 <sup>c</sup>	0.030 0.000
Sales Growth	0.174 [0.040]	0.273 [0.062]		0.106 [0.032]		0.089 [0.009]		0.183 <sup>a</sup> 0.053 <sup>a</sup>	0.007 0.000
Assets Growth	0.171 [0.031]	0.229 [0.044]		0.179 [0.023]		0.056 [0.014]		0.173 <sup>a</sup> 0.030 <sup>a</sup>	0.000 0.000
Market-to-Book	1.778 [1.416]	1.895 [1.532]		1.736 [1.324]		1.620 [1.298]		0.276 <sup>a</sup> 0.234 <sup>a</sup>	0.000 0.000
Capital Investment	0.056 [0.045]	0.066 [0.050]		0.051 [0.047]		0.046 [0.037]		0.020 <sup>a</sup> 0.013 <sup>a</sup>	0.000 0.000

results in Table 6.9 demonstrate large differences in investment opportunities between divesting firms selling in high- and low-liquidity markets. For instance, high-liquidity divesting firms have a market-to-book ratio of 1.895, which is significantly larger than low-liquidity firms by 0.352. For liquidity supply portfolios, the difference in market-to-book ratio is also positive (0.276) and significant at 1% level.

Although both measures of aggregate liquidity deliver similar results in many variables, as indicated in Tables 6.9 and 6.10, the results of some variables are inconsistent. For example, although high-liquidity demand sales are larger in size, high-liquidity supply sales are significantly smaller in total assets and market value of equity. Note that, although I investigate the influences of both aggregate liquidity measures on the performance of asset sales and characteristics of divesting firms, it is not necessary that both measures should always have coherent results.

Overall, by comparing firm characteristics, I find strong evidence that divesting firms selling assets in high-liquidity periods have better short-term and long-term growth opportunities than those announcing asset sales in low-liquidity periods. The differences in the market-to-book and assets growth across liquidity subsamples are both positive and statistically significant.

### **6.4.3 Long-Run Performance of Divesting Firms**

In this section, I estimate the long-run abnormal returns to divesting firms after the announcement of asset sales, and compare the average BHAR across different liquidity portfolios. To the best of my knowledge, only two papers in the literature on asset sales have investigated the long-run performance of divesting firms. Bates (2005) uses the factor model regressions for 24-month rolling event time portfolios formed on asset sale observations. By using the factor specification employed in Eckbo, Masulis, and Norli (2000), Bates (2005) finds that only the subsample of retaining firms has positive performance. Firms retaining sales proceeds outperform

**Table 6.11: Long-term Buy-and-Hold Abnormal Returns**

This table presents the divesting firms' post-sale buy-and-hold abnormal returns (BHAR) for various aggregate liquidity portfolios. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. Asset sales announced in the next year ( $t+1$ ) of the lowest (or highest) 30% aggregate corporate liquidity demand ( $\Delta L/S$ ) or aggregate market liquidity supply ( $Debt/GDP$ ) years ( $t$ ) are put into the low (or high) liquidity demand portfolios or liquidity supply portfolios, respectively. Panel A (Panel B) shows the results of liquidity demand portfolios based on  $\Delta L/S$  (liquidity supply portfolio based on  $Debt/GDP$ ). To calculate BHAR, I first calculate the buy-and-hold returns (BHR) for each event firm for a period ranging from 1 month to 12, 24, or 36 month respectively, where month 0 is the effective month in divestitures:  $BHR_{iT} = \prod_{t=1}^T (1 + R_{it}) - 1$ , where  $i$  is the event-firm index,  $R_{it}$  is the month  $t$  simple return on firm  $i$ , and  $T$  is the horizon over which the  $BHR_{iT}$  is computed. Then the BHR for a reference portfolio is calculated as  $BHR_{p_i,T} = \prod_{t=1}^T [1 + \sum_{j=1}^{N_t} R_{jt}/N_t] - 1$ , where  $p_i$  is the index for the reference portfolio of the event firm  $i$ ,  $N_t$  is the number of firms in the reference portfolio in month  $t$ , and  $R_{jt}$  is the return for firm  $j$  in the reference portfolio  $p_i$  during the event-month  $t$  for event firm  $i$ . The mean BHAR are then calculated as  $BHAR_T = \frac{1}{N} \sum_{i=1}^N (BHR_{iT} - BHR_{p_i,T})$ , where  $N$  is the number of event firms that have valid BHR for event period 12, 24, or 36 months. The differentials between high-liquidity portfolios and low-liquidity portfolios are reported where statistical significance is obtained using two sample  $t$ -tests.  $t$ -statistics are provided in parenthesis. Superscripts  $a$ ,  $b$ , and  $c$  indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

Event Periods	All Asset Sales	High (30%) Liquidity	Medium (40%) Liquidity	Low (30%) Liquidity	Differences (High-Low)
<b>Panel A: Liquidity Demand (<math>\Delta L/S</math>)</b>					
1 Year	-0.02% (-0.01)	2.01% (0.59)	-0.39% (-0.26)	-1.97% (-0.68)	3.98% (0.89)
2 Year	-0.22% (-0.09)	-0.43% (-0.09)	3.98% (1.34)	-5.45% (-1.21)	5.03% (0.76)
3 Year	6.07% (0.91)	2.64% (0.44)	23.30% (1.40)	-12.32% <sup>a</sup> (-2.74)	14.96% <sup>b</sup> (2.00)
<b>Panel B: Liquidity Supply (<math>Debt/GDP</math>)</b>					
1 Year	-0.02% (-0.01)	2.45% (1.17)	-1.27% (-0.36)	-3.18% <sup>c</sup> (-1.79)	5.63% <sup>b</sup> (2.05)
2 Year	-0.22% (-0.09)	8.21% <sup>c</sup> (1.77)	-9.79% <sup>a</sup> (-3.55)	-3.23% (-1.03)	11.44% <sup>b</sup> (2.04)
3 Year	6.07% (0.91)	22.20% (1.55)	-13.31% <sup>a</sup> (-3.98)	1.85% (0.39)	20.40% (1.35)

by over one half of one percent per month, which is equal to an economically significant risk-adjusted return of 18.22%. Lee and Lin (2008) examine the long-run performance of U.K. corporate sell-offs, and observe significantly negative abnormal returns up to five years after sell-off announcements.

Table 6.11 shows the divesting firms' post-sale BHAR in the long-horizon. For the whole sample, unlike Lee and Lin (2008), I find no evidence of post-sale underperformance by divesting firms. On average, divesting firms seem to have post-sale returns indifferent from zero. However, I find partial evidence that low-liquidity sellers experience negative abnormal returns after asset sales. Moreover, the differences in BHAR between high- and low-liquidity asset sales are significantly positive, which are shown in the last column in Table 6.11, and the degree of differences increases in the length of post-event periods. The results of long-term BHAR suggest that high-liquidity divesting firms significantly outperform low-liquidity divesting firms in the three years after asset sales. This correlation is consistent with earlier analyses of the characteristics of divesting firms, which indicate that divesting firms selling in high-liquidity periods have better short-term and long-term growth opportunities.

#### **6.4.4 Multivariate Evidence on CAR and BHAR**

Table 6.12 summarises the results of the multivariate regressions of three-day announcement period CAR and two-year post-sale BHAR on the following variables. To evaluate the degree to which short-term and long-term abnormal returns are affected by factors of aggregate liquidity, each regression includes a high (medium) liquidity dummy, which equals one if divesting firms announce sales in high- (medium-) liquidity markets and zero otherwise. To capture the size effect, the relative transaction size is included, which is measured as the market value of the transaction divided by the divesting firm's pre-sale total assets. The high growth dummy, which takes the value of one if divesting firms have a market-to-book ratio above the medium firm



**Table 6.12: OLS Regressions Analysis of BHAR and CAR**

This table presents the results of ordinary least squares regressions of three-day CAR to asset sales announcements and two-year BHAR after asset sales. The sample of asset sales consists of 2,793 subsidiary sales between 1985 to 2004 by public listed non-financial corporations (excludes firms with SIC codes between 6000 and 6999) and non-utility corporations (excludes firms with SIC codes between 4900 and 4999), where the transaction entails a minimum payment of one million U.S. dollar in transaction value to the divesting firm. Transactions include only those where the divesting firms can be identified on CRSP and Compustat. High Liquidity Dummy (Medium Liquidity Dummy) equals one if the asset sale was announced in a high-liquidity (medium-liquidity) market and zero otherwise. Relative transaction size is the market value of the transaction divided by the divesting firm's pre-sale total assets. Dummy variables equal one for firms reporting a corresponding variables above that of the medium firm and zero otherwise. Table 6.3 details the variable construction. The independent variables are all measured at the end of the previous fiscal year before the sales, except for capital investment which is measured in the fiscal year following the sales. *t*-statistics are provided in parenthesis. Superscripts *a*, *b*, and *c* indicate significant at the 1, 5, and 10 percent levels, respectively. Median values are reported in brackets.

Dependent Variables	Liquidity Demand						Liquidity Supply					
	Two-Year BHAR			Three-Day CAR			Two-Year BHAR			Three-Day CAR		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	-0.100 <sup>c</sup> (-1.94)	-0.035 (-0.54)	0.012 <sup>a</sup> (2.89)	0.008 (1.38)	-0.069 (-1.24)	-0.017 (-0.26)	0.016 <sup>a</sup> (3.59)	0.012 <sup>b</sup> (2.18)				
High Liquidity Dummy	0.016 (0.26)	-0.032 (-0.56)	-0.003 (-0.53)	0.002 (0.46)	0.108 <sup>c</sup> (1.72)	0.095 (1.62)	-0.002 (-0.30)	0.000 (0.05)				
Medium Liquidity Dummy	0.104 <sup>c</sup> (1.72)	0.074 (1.35)	0.004 (0.84)	0.004 (0.88)	-0.066 (-0.99)	-0.072 (-1.18)	-0.006 (-1.19)	-0.006 (-1.14)				
Relative Transaction	-0.008 (-0.11)	-0.024 (-0.31)	0.038 <sup>a</sup> (6.24)	0.050 <sup>a</sup> (7.85)	-0.017 (-0.21)	-0.035 (-0.46)	0.038 <sup>a</sup> (6.23)	0.050 <sup>a</sup> (7.83)				
High Growth Dummy	0.117 <sup>b</sup> (2.37)	0.095 <sup>b</sup> (2.04)	-0.008 <sup>b</sup> (-1.99)	-0.007 <sup>c</sup> (-1.84)	0.092 <sup>c</sup> (1.89)	0.065 (1.41)	-0.009 <sup>b</sup> (-2.31)	-0.008 <sup>b</sup> (-2.00)				
High Investment Dummy		-0.019 (-0.42)		-0.001 (-0.35)		-0.024 (-0.54)		-0.001 (-0.35)				
High Cash Dummy		0.044 (0.95)		0.005 (1.30)		0.048 (1.04)		0.005 (1.27)				
High Leverage Dummy		-0.092 <sup>b</sup> (-1.99)		0.002 (0.44)		-0.096 <sup>b</sup> (-2.08)		0.002 (0.43)				
Adjusted <i>R</i> <sup>2</sup>	0.002	0.004	0.017	0.030	0.005	0.008	0.017	0.031				
Number of Observations	2248	1993	2329	2024	2248	1993	2329	2024				

in the sample and zero if it is below the medium firm, is included to control for the effect of growth opportunities on the stock performance. To account for the market's expectation about the post-sale capital investment of a divesting firm, I also include the high investment dummy. To incorporate capital structure and financial flexibility considerations, I further include high cash dummy and high leverage dummy measured for the divesting firm in the fiscal year preceding the sale.

The left sub-panel of Table 6.12 shows the regression results for the aggregate liquidity demand dummy variable. The coefficient on the high (medium) liquidity dummy is positive, suggesting that high-liquidity sales experience positive post-sale abnormal returns. However, these coefficients become insignificant in Model 2 when other dummies are included. For factor of liquidity demand, the liquidity dummy only delivers a modest correlation with performance of asset sales. When liquidity supply is applied, the coefficients on the high liquidity dummy are positive and significantly different from zero in Models 5 and 6. These results suggest that shareholders react more favourably to asset sales announced in high-liquidity markets in the long-run. However, no such pattern has been found for short-run CAR around asset sales announcements. When the dependent variable is the three-day CAR, coefficients on high and medium liquidity dummies are close to zero. As indicated in Table 6.12, coefficients on the high growth dummy are statistically significantly positive for regressions on the two-year post-sale BHAR and negative for regressions on the three-day announcement CAR. These results imply that returns to sales, especially in the long-term, are higher when growth opportunities are significant.

## 6.5 Conclusion

Considering the existence of market anomalies associated with asset sales and the importance of liquidity consideration in decision making, this chapter investigates the correlation between aggregate liquidity and asset sales. As an important macro

factor, aggregate liquidity should carry potentially important implications on corporate divestitures. The purpose of this chapter is, therefore, to explore whether aggregate liquidity factors can explain the variations in asset sales markets and the relative valuation phenomena associated with asset sales. In particular, I want to investigate whether there are fundamental differences between the quality of asset sales announced under high aggregate liquidity periods and those occurring in low aggregate liquidity periods.

The main results from this chapter suggest the following points. First, more asset sales are undertaken during high-liquidity periods with larger relative transaction sizes. Second, divesting firms selling assets in high-liquidity periods have stronger short-term and long-term growth opportunities, measured by asset growth and market-to-book ratios, than divesting firms in low-liquidity periods. Third, high-liquidity divesting firms have positive and larger BHAR over three years after asset sales than low-liquidity divesting firms, which experience negative post-sale performance. Overall, evidence has been found to support the notion that aggregate liquidity does affect the performance of asset sales, although some results are inconsistent.

# Chapter 7

## Conclusion

Liquidity is an important and special asset for firms operating in imperfect capital markets. At the aggregate level, corporate liquidity holdings and market liquidity supply play important roles in capital markets. The variation of aggregate liquidity affects the activity of corporate investment and financing, and even the performance of event companies. Many studies on the importance of liquidity (at both firm-level and aggregate-level) suggest that the level and variation of (aggregate) liquidity substantially influence the activity and quality of corporate investment and financing. Motivated by these previous studies, I investigated whether corporate investment and external financing occurring during high aggregate liquidity markets are fundamentally different from those occurring during low aggregate liquidity environments.

Using M&A, IPO, SEO, and asset sales samples, I found strong empirical evidence that the activities of these typical corporate investment and financing events are affected by aggregate liquidity. Moreover, the quality of these investment and financing decisions and the performance of event firms, both in the short- and long-term, are also influenced by aggregate liquidity. Moreover, many of the market anomalies associated with corporate events only exist in certain aggregate liquidity circumstances, and the differences in performance between corporate events initiated in high- and low-liquidity markets are both economically and statistically significant.

The empirical results and patterns demonstrate that many of the widely documented abnormal performances associated with event firms can be explained by aggregate liquidity factors. For most of the cases, the abnormal performance of event firms in the entire sample is mainly driven by those initiated in high aggregate liquidity markets, which suggests that market anomalies related with typical corporate finance events are the consequences of deals in bad circumstances. Overall, in this thesis, I find that corporate investment and financing events undertaken in high-liquidity markets are fundamentally different from those undertaken in low-liquidity markets.

This research is a preliminary effort to analyse the importance of aggregate liquidity for the activity and quality of corporate events. It is certain that there are many prospects for improvement and future research. In this thesis, I employed measures of aggregate corporate liquidity demand (ACLD) and aggregate market liquidity supply (AMLS). Unfortunately, unlike the factors of market valuation used in market timing theory, aggregate liquidity factors are constructed with financial and accounting data. These types of accounting and economic data are mostly updated annually. Therefore, I can only construct annual time-series data of aggregate liquidity in this research, and the sample period of each corporate investment and financing event can only be partitioned on an annual basis. Although I do not expect aggregate liquidity data to change greatly with high frequency, employing liquidity measures with a higher frequency might create stronger evidence.

Second, considering the importance of liquidity, it is reasonable to expect that other corporate activities may also be affected by aggregate liquidity. For instance, existing research in corporate finance shows that firms might choose to pay out dividends or repurchase stocks back when holding extra cash. The timing of financing decisions has attracted much attention for a relatively long time. Since the undertaking of these behaviours has explicit and implicit correlations with liquidity, examining the influences of aggregate liquidity on the quality of these dividend payouts and stock repurchase events should create new insights.

Third, in the present thesis, acquiring firms in M&A, issuing firms in IPOs and SEOs, and divesting firms in asset sales were considered separately in relation to aggregate liquidity factors. However, since the participants in M&A, IPOs, SEOs, and asset sales are all connected in certain ways, it is worthy to have further investigations considering various event firms simultaneously. For instance, the target firms in takeovers and the divesting firms in asset sales are similar; only that divesting firms positively sell their assets without losing controls of their firms. The issuing firms in IPOs or SEOs are potential candidates for corporate divestitures. When the external public financing are more costly, firms would prefer divestitures to equity issuances. Therefore, some interesting questions include: When the external markets are short of liquidity, how should acquiring firms select target firms in acquisitions? What type of financing methods should be used by various firms in low-liquidity periods?

Finally, most of the empirical tests in this thesis were carried out by separating the sample of corporate events through time periods. However, making a further analysis of cross-section examinations should generate interesting and fruitful results. For example, it is interesting to ask: When there is an aggregate liquidity shortage in capital markets, whether liquidity-rich firms will still spend cash lavishly in value-decreasing acquisitions, or whether acquiring firms will prefer to takeover companies with more liquidity reserves? Future research in this line could add contributions to previous studies analysing firm characteristics and their influences on corporate investment and financing decisions.

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